# A REVISION OF THE AUSTRALIAN AND TASMANIAN GRIPOPTERYGIDAE AND NEMOURIDAE (PLECOPTERA)

*By* D. E. KIMMINS

SYNOPSIS

In this paper sixteen new species of the family Gripopterygidae and four in the family Nemouridae are described. The Australian species of Nemouridae are transferred to the subfamily Notonemourinae Ricker, containing nine genera with a distribution ranging over Australia, Tasmania, New Zealand, southern South America, and Cape Province, South Africa. The type of the genus *Leptoperla* Newman has been studied and redescribed, with the result that a later genus described by Enderlein must fall into synonymy. In addition, the nymphs of three genera of the Gripopterygidae are described and figured.

THE Gripopterygidae are the dominant Plecopterous family in Australia and New Zealand; Tillyard gave ten as the number of Australian and Tasmanian species, a figure which included some undescribed species in his collection, as only eight species had then been published, contained in five genera. Examination of the British Museum accessions and the Tillyard collection has enabled this list to be increased by sixteen new species and the genera to be reduced to four.[1] In addition, it has been possible to describe the nymphs of three of the genera, and it is highly probable that there are still more species to be described, as more than one species of *Trinotoperla* nymph has been recognized from Tasmania, whence no adult has yet been recorded. Apart from Australia, Tasmania, and New Zealand, this family also occurs in the Fiji Islands, Auckland Islands, and the colder, mountainous parts of South America.

The Nemouridae are represented in Australia and Tasmania by five species (four here described for the first time), in two genera. For these insects Dr. Ricker's subfamily name Notonemourinae is adopted. This subfamily is not restricted to Australia and New Zealand, but occurs also in southern South America and in the mountain ranges of Cape Province, South Africa. In the latter region they are the dominant Plecoptera, seventeen species in four genera being listed by Barnard, the only other Plecoptera recorded being two sub-tropical Perlidae. Further collecting in Australia should produce more species, their small size and dull colouring no doubt causing them to be overlooked, but according to Tillyard they are decidedly less common than the Gripopterygidae.

It is difficult to understand why this nemourid subfamily should have established itself so securely in the mountains of Cape Province, whereas the Gripopterygidae, which occur with it in other regions, are apparently absent. This absence would not seem to be due to lack of collecting, as Tillyard asked Dr. Barnard to make a special search in this region in the hope of finding examples of Gripopterygidae. Fossil records may show whether this family did ever exist in the Cape, but if they did, they appear to have died out. The South African Notonemourinae would appear to have been isolated for a longer period than the Australian and South American forms, as

[1] Unless otherwise stated, types of the new species are in the British Museum (Nat. Hist.).

all the four South African genera are absent from the other regions. *Udamocercia* occurs in South America and Tasmania, two genera are known only from New Zealand, and *Spaniocerca* occurs in Australia, Tasmania, and New Zealand.

## GRIPOPTERYGIDAE Enderlein

*Gripopterygidae* Enderlein, 1909, *Zool. Anz.* **34:** 388.
*Leptoperlini* Banks, 1913, *Trans. Amer. Ent. Soc.* **39:** 202.
*Leptoperlidae* Tillyard, 1921, *Canad. Ent.* **53:** 36; 1921, *Trans. Roy. Soc. S. Aust.* **45:** 270–273; 1923, *Trans. N. Zeal. Inst.* **54:** 202–203; 1926, *Ins. Aust. & N.Z.*: 119.

Tillyard has adopted for this family the name *Leptoperlidae*, but the reasons which he has set out in its support are, unfortunately, based upon a misunderstanding of an early paper by Newman. Tillyard (1921) writes: 'This family was first recognised as a distinct group by Newman in 1839, and has been raised to tribal rank by Banks under the name Leptoperlini, these authors not considering the whole of the Perlaria to be entitled to more than family rank. Now that the ordinal rank of the Perlaria is well established, the various tribes of Banks take family rank.'

In the first place, Newman merely erected a new genus, *Leptoperla*, with one species, *beroë*, and his introduction makes it clear that it was a genus of the family Perlidae. No mention is made that it belonged to a 'distinct group'. Secondly, Newman did not consider the whole of the Plecoptera to belong to one family. He heads his paper 'Class—NEUROPTERA. Natural Order—PERLITES. Family—PERLIDAE', and in his first paragraph he states that he uses the family Perlidae in a restricted sense, 'including only those genera which are furnished with caudal setae: Leach and Stephens incorporate with them the ecaudate Nemourae'. Thus it is evident that he recognized at least two families in what are now called Plecoptera.

The first worker to give family rank to this section of the Plecoptera was Enderlein, who in 1909 proposed the name Gripopterygidae; his family was a rather composite one, including the genera *Paragripopteryx* Enderlein, *Gripopteryx* Pictet, *Eusthenia* Gray, *Stenoperla* McLachlan, *Antarctoperla* Enderlein, *Notoperla* Enderlein, and *Paranotoperla* Enderlein, but omitting *Leptoperla* Newman. In 1913, under the tribal name Leptoperlini (sub-family Pteronarcinae), Banks groups *Austroperla* Needham, *Gripopteryx* Pictet, *Leptoperla* Newman, *Notoperla* Enderlein, *Aucklandobius* Enderlein, *Antarctoperla* Enderlein, and *Paranotoperla* Enderlein. Tillyard in 1921 raised Bank's tribe to family status and at the same time separated off *Austroperla* to form a distinct family.

*Leptoperla* Newman undeniably belongs to the same family as *Gripopteryx* Pictet, *Paranotoperla* Enderlein being actually a synonym of *Leptoperla*, and thus the name Leptoperlidae must give place to Gripopterygidae on grounds of priority.

### *Diagnosis of family*

Fore wing with Sc terminating at from one-half to two-thirds of the wing length from the base, thus leaving a long pterostigmatic area, with or without cross-veins. Cross-veins, more or less numerous, are present in the distal half of the wing, and there is no transverse cord. Three anal veins present, first long, second and third shorter and fused at their bases. On posterior margin, between the terminations of

Cu1 and Cu2, the marginal fringe of hairs is modified into a row of hooked hairs, probably a form of wing-coupling. I have not seen this structure in any other family of Plecoptera, nor have I seen any previous record of it. In the hind wing, M3+4 is always fused with Cu1 shortly after it separates from M1+2; it may remain thus fused with Cu1 to the margin of the wing, or it may separate again, thus appearing like a fork of Cu1. Anal fan always forming an angle with the hind margin of the wing, and containing only six simple veins, including 1A; it is generally without cross-veins.

The nymphs may be readily distinguished by the tuft or rosette of filiform anal gills, whitish, pinkish, or pale mauve in colour. According to Tillyard, these nymphs are sluggish in habits, being found clinging to rocks in the swifter parts of fast-running streams. In the more mature nymphs the developing wing pads show the main venation of the adults quite clearly, and by this means it has been possible to recognize the nymphs of the three genera *Trinotoperla*, *Dinotoperla*, and *Leptoperla*.

## Key to Genera of Gripopterygidae of Australia, Tasmania, New Zealand, and Auckland Islands

1. Rs forked in both pairs of wings . . . . . 2
   Rs simple in both pairs of wings . . . . . 5
2. Cu1 in fore wing forked . . . . . 3
   Cu1 in fore wing simple . . . . . 4
3. A series of cross-veins between Cu2 and 1A in fore wing
   Eunotoperla Tillyard, p. 47
   Not more than one cross-vein in this area . . Trinotoperla Tillyard, p. 75
4. Fork of Rs long . . . . . Megaleptoperla Tillyard
   Fork of Rs terminal . . . . . Zelandobius Tillyard
5. M3+4 and Cu1 in hind wing separate at base and apex, fused in middle of wing
   Dinotoperla Tillyard, p. 62
   M3+4 and Cu1 separate at base of hind wing, fused from centre of wing to margin . . . . . 6
6. Generally only one cross-vein between Cu1 and Cu2 in hind wing
   Leptoperla Newman, p. 48
   More than two or three cross-veins in this area . . . . . 7
7. A series of cross-veins in the pterostigma in both wings
   Zelandoperla Tillyard
   No cross-veins in the pterostigma . . . . . 8
8. Fore wings shorter than the hind wings . Aucklandobius Enderlein
   Fore wings longer than hind wings . . . Nesoperla Tillyard

### *EUNOTOPERLA* Tillyard

*Eunotoperla* Tillyard, 1924, *Trans. Roy. Soc. S. Aust.* **48:** 194.
Type species: *E. kershawi* Tillyard, 1924 (fixed by Tillyard, 1924).

This genus is so far not represented in the British Museum (Nat. Hist.) and I am therefore quoting Tillyard's descriptions.

'Fore wing with Rs distally forked or three-branched, M forked from near middle of wing, Cu1 three-branched, or more rarely, simply forked; a thickened cross-vein between 1A and 2A; cells between M and Cu partially double; cubito-anal space with cross-veins. Hind wing with Rs terminally forked or simple, M forked, Cu1 forked or simple; apex well rounded; anal fan moderately wide, with a few weak cross-veins developed in the region of 1A and 2A. Cerci short. Size of species large, expanding 50 mm. or more.

'This genus shows an approach to the Eustheniidae in the beginning of the development of cross-veins on the anal fan, and is in other respects somewhat similar to the genus *Stenoperla* of that family; it can be at once distinguished by the marked angle between the border of the anal fan and the rest of the hind wing, this angle being entirely absent in the Eustheniidae.'

*Distribution*: AUSTRALIA, Victoria.

### ***Eunotoperla kershawi*** Tillyard

FIG. 1

*Eunotoperla kershawi* Tillyard, 1924, *Trans. Roy. Soc. S. Aust.* **48:** 195, fig. 2; 1926, *Ins. Aust. & N.Z.*: 119, pl. 10, fig. 16.

'♂. Length of body (abdomen much shrunken): 11 mm., of fore wing 25 mm., antennae 16 mm., cerci 4 mm. Body, legs, and antennae blackish, with front border of

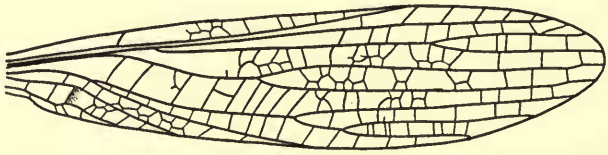

FIG. 1. *Eunotoperla kershawi* Tillyard. Right fore wing (after Tillyard).

pronotum brownish. Wings dull brownish with dark brown venation; cross-veins nearly all enclosed in pale transparent whitish areas; thickened cross-vein between 1A and 2A of fore wing dark brown; supra-anal plate with a copulatory process in the form of a slender, downcurved spine; paraprocts with a pair of shorter, upcurved spines.

'♀. Length of body (not shrunken): 25 mm., fore wing 30 mm.; differs from male in having abdomen and pronotum brown, wings dark brown, the hind wings somewhat fuscous.

'Types: Holotype male and allotype female (Warburton, Victoria, 12.94) in National Museum, Melbourne; paratype male, from same locality, in Cawthron Institute collection, Nelson, N.Z., also a male from Thorpdale, Gippsland.'

## ***LEPTOPERLA*** Newman

*Leptoperla* Newman, 1839, *Mag. Nat. Hist.* **3** (n.s.): 89.
Type species: *L. beroë* Newman 1839 (only species included by Newman).
Walker, 1852, *Cat. Ins. B.M.* **1:** 169; Banks, 1913, *Trans. Amer. Ent. Soc.* **39:** 203; Tillyard, 1921, *Canad. Ent.* **53:** 42, fig. 4*a*; 1921, *Trans. Roy. Soc. S. Aust.* **45:** 273.
*Paranotoperla* Enderlein, 1909, *Zool. Anz.* **34:** 393, 416 (**Syn. nov.**)

Type species: *P. australica* Enderlein (fixed by Enderlein, 1909).
Enderlein, 1909, *Dtsch. Ent. Z.* **1909:** 634, fig. 2; Tillyard, 1921, *Trans. Roy. Soc. S. Aust.* **45:** 273.

Newman's description of the genus is very brief. 'Proalarum nervurae apicales 6, nervuris transversis numerosis intersectae: antennae setaeque caudales elongatae; pedes elongati.'

The type of *L. beroë* is gummed on a card and the wings are somewhat crumpled. Tillyard examined the specimen in 1920 and gave an extended generic diagnosis in the *Canadian Entomologist*. For some reason he did not completely spread out the left fore wing when he softened it for examination, and consequently the fact that the right fore wing (with Rs forked almost to its origin) was abnormal escaped his notice. Through the courtesy of Professor G. Hale Carpenter I have been able to study, amongst other Australian material, the type of *L. beroë*. Included in this material was an example resembling *beroë*, but without the forked Rs in the fore wing. This

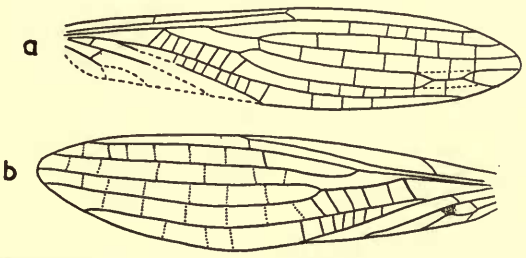


FIG. 2. *Leptoperla beroë* Newman, ♂ type. *a*, right fore wing (after Tillyard, showing aberrant fork of Rs); *b*, left fore wing (original).

aroused my suspicions and I removed and spread out the left fore wing of the type. In this, Rs was simple and the whole venation was of the pattern of *Paranotoperla* Enderlein (Fig. 2 *b*). Genitalia and cerci also agree with that genus, and I have no hesitation in placing Enderlein's genus in the synonymy of *Leptoperla*.

The following is my revised diagnosis of the genus. Fore wing with Rs simple, M forked near the middle of the wing, Cu1 simple; cubito-anal space with only one cross-vein: a thickened cross-vein between 1A and 2A. Hind wing with Rs simple, Rs and M generally separating close to the base of the wing; in *L. rugosa*, *L. reticulata*, and *L. nigrifrons* they remain fused for a much greater distance; posterior branch of M fused with Cu1 from near the fork of M to the wing margin. Generally only one cross-vein between the branches of Cu. Anal fan rather narrow. Cerci long.

*Distribution*: Australia, Tasmania, Fiji Islands.

## *Leptoperla beroë* Newman

FIGS. 2, 3

*Leptoperla beroë* Newman, 1839, *Mag. Nat. Hist.* **3** (n.s.): 89–90; Walker, 1852, *Cat. Neur. Ins. B.M.* **1:** 169; Banks, 1913, *Trans. Amer. Ent. Soc.* **39:** 203; Tillyard, 1921, *Canad. Ent.* **53:** 42, fig. 4*a*; 1921, *Trans. Roy. Soc. S. Aust.* **45:** 273; 1926, *Ins. Aust. & N.Z.*: 119.

Newman's description (given below) is good, but owing to the aberrant fore wing, his statement that there are *six* parallel veins in the fore wing should be read as *five*.

'Sp. 1. *Leptoperla Beroë*. Fusca, alae opacae, fuscae, versus apicem maculis

albidis notatae; pro- et mesopedes fusci, tibiis medio testaceis: metafemora testacea, apice fusca. (Corp. long. ·3 unc. ant. ·475 unc. set. caud. ·475 unc. alar. dilat. ·9 unc.)

'This is a slender and very elegant insect, it differs generically from *Isogenus* and *Perla* in the neuration of the fore wings, the exterior portion of which is occupied by six strong parallel longitudinal nervures; of these the fourth is furcate at the extremity and the fifth unites with the fourth just before its furcation;[1] these longitudinal nervures are intersected by several very delicate transverse nervures: the *antennae* and caudal *setae* are very slender, and much longer than the body of the insect; the terminal segment of the *abdomen* is furnished below with two leaf-like processes, which curve upwards, passing between the caudal *setae* and terminating in acute points: the legs are very long and slender: the insect is of a dark brown colour, the wings being opaque, dark brown, and the exterior portion of the fore wings regularly spotted with dirty white; the hind wings are immaculate; the *pro-* and *mesofemora* having a bright testaceous ring; the *metafemora* are testaceous, with the apex only dark brown, the *tibiae* are rather paler, and the tarsi nearly black.

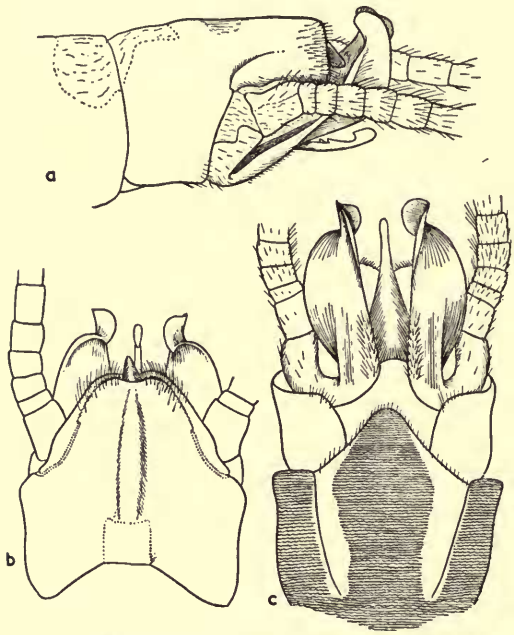


FIG. 3. *Leptoperla beroë* Newman, ♂. Genitalia, *a*, lateral; *b*, dorsal; *c*, ventral.

'Inhabits Van Diemens Land. There is a single specimen in the cabinet of the Rev. F. W. Hope.' (Now in the Hope Department, University Museum, Oxford.)

To this description may be added the following account of the male genitalia. Apical tergites pigmented at bases and sides, sternites with a pair of basal spots. Tenth tergite large, narrowed apically, apical margin truncate from the side and carrying a short triangular process. There is a low median dorsal carina, and at the centre of the basal margin is a small quadrate, membranous area. Supra-anal lobe slender, not projecting much beyond the margin of the tergite. From the side there is a dorsal excision before the apex. giving the appearance of a crochet-hook, and several acute dorsal teeth. Sub-anal plates large, broad, leaf-like, curving upwards, with somewhat twisted apices; lower basal margins heavily fringed with hairs. Cerci long, at least thirty-seven-segmented. Subgenital plate triangularly produced, pigmented at its centre, giving the impression of being narrower.

The above genitalic description has been made from a second example in the Hope Department, University Museum, Oxford.

[1] Tillyard has shown this to be an aberration; in the left fore wing all these veins run parallel.

## *Leptoperla australica* (Enderlein)

FIG. 4

*Paranotoperla australica* Enderlein, 1909, *Zool. Anz.* **34:** 416; 1909, *Dtsch. Ent. Z.* **1909:** 684; 1912, *Fauna SW. Aust.*: 60; Tillyard, 1921, *Trans. Roy. Soc. S. Aust.* **45:** 270; ? Šámal, 1921, *Časopis*, **18:** 66–70.

Šámal's reference to the occurrence of this species in Tasmania is probably based on a mis-determination and may possibly refer to *L. beroë*. I have not seen any examples of *L. australica* from the island and I believe it to be restricted to west and south-west Australia.

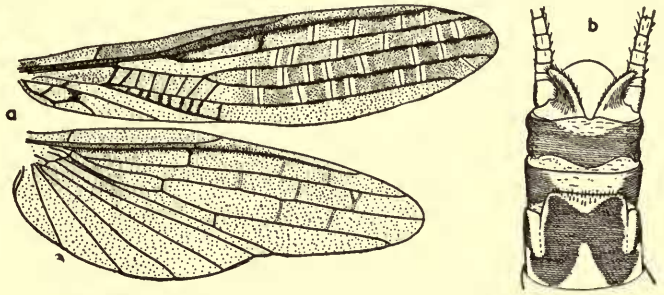


FIG. 4. *Leptoperla australica* (Enderlein) ♀. *a*, wings; *b*, genitalia, ventral.

Head brownish-yellow, darker above. Eyes black. Thorax brown, almost rectangular, somewhat longer than broad, front and hind margins straight, lateral margins straight and diverging slightly from front to back; no impressed median line, but with anterior and posterior transverse furrows; anterior angles rounded. Abdomen light brown, in the female paler beneath, subgenital plate brown. Cerci dark brown, longer than abdomen, about thirty segments. Legs brownish-yellow, marked with dark brown at the knees, apices of tibiae, and on the tarsi. Wings light brown, with brown venation, distal cross-veins pale and enclosed in whitish spaces; generally without cross-veins between Cu1 and wing margin in fore wing.

I have seen no males; Enderlein says that the last tergite in this sex is triangular. His description of the subgenital plate apparently refers to the female.

♀. Subgenital plate large, quadrate, angles rounded, projecting somewhat beyond the segment, brown, with pale triangular excised areas, a broad shallow area at apex and a narrow deep one at base. Sub-anal plates triangular, apices curving outward.

Length of fore wing ♂ 9·5–10 mm., ♀ 7·5–9·5 mm.

Length of hind wing ♂ ?, ♀ 6·5–8·5 mm.

SW. AUSTRALIA: Lunenberg, 22.ix.1905, Serpentine, 23–25.ix.1905, Harvey, 27.vii.1905 (Hamburg SW. Australia Expedition). WEST AUSTRALIA: Bolgonup, 1.x.1922 (R. J. Tillyard).

Type in Stettin Museum.

## *Leptoperla tasmanica* sp.n.

FIG. 5

(In fluid.) Head, thorax, and three terminal segments of abdomen brown, shining, segments one to seven whitish. Antennae longer than fore wing. Pronotum

trapezoidal, anterior margin two-thirds as wide as posterior, a little shorter than width at base. Legs brownish, distinctly banded with dark brown towards apex of femur and base of tibia, apex of tibia and tarsus clouded with darker brown. Wings elongate, fore wing medium fuscous, with pale markings; all cross-veins, and to a lesser degree

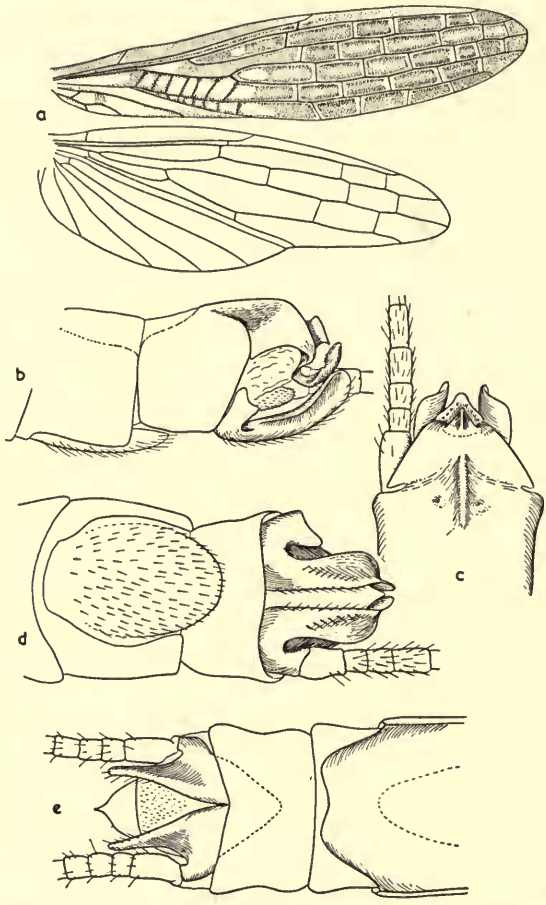


FIG. 5. *Leptoperla tasmanica* sp.n. *a*, wings, ♂; *b–d*, genitalia ♂, left cercus omitted, *b*, lateral, *c*, dorsal, *d*, ventral; *e*, genitalia ♀, ventral.

also the longitudinal veins in the apical half margined with whitish, so that each cellule is dark, surrounded by a pale line. In female, cross-veins are more numerous, and main veins are not bordered with whitish, only the cross-veins. In the basal half of the wing it is the cells which are pale, bordered with fuscous. Veins pale fuscous, except apical cross-veins which are whitish (pale purplish in dried examples). Hind wing uniform pale fuscous, with darker veins.

♂. Ninth tergite with a large unpigmented area on dorsum, extending almost to base. Tenth tergite with a strong longitudinal ridge, and on each side of it a small rounded depression, base of segment unpigmented; apical margin triangularly produced, apex truncate, bent down from the side, and carrying a ridged projection,

triangular from above, quadrate from the side, its lower apical angle acute. Supra-anal lobe broad, triangular, curving upward, its upper surface set with teeth. Cerci brownish, at least as long as abdomen (incomplete in type), more than twenty-three-segmented, basal segment pale. Sub-anal plates blunt, curving upward, upper margin curved over outward. Above them is a small setose lobe. Subgenital plate ovate, projecting about a quarter of its length beyond the sternite, separated from the segment by an unpigmented band.

♀. Dorsum of eighth and ninth segments membranous, tenth pigmented, triangularly produced and deflexed, terminating in a slender blackened spine; dorsally there are two small rounded pits similar to those in the male. Subgenital plate broad at base, narrowed to half its width at apex, which is shallowly emarginate or sometimes merely truncate. It extends nearly to the apex of ninth sternite, and is brownish, with a narrow triangular whitish area, the base of the triangle adjoining the basal margin of the plate. Anal plates triangular, apices produced in flattened fingers. Cerci brownish, about twice as long as abdomen.

Length of fore wing ♂ 12 mm., ♀ 12 mm.

Length of hind wing ♂ 10 mm., ♀ 10 mm.

TASMANIA: Gouldt County, 10.ii.1933, 1 ♂; Penstock Lagoon, 27–29.i.1933, 3 ♀ (R. J. Tillyard); Great Lake, ii.1934, 2 ♀ (Critchley Parker).

Type ♂ (from Gouldt County) and a paratype female from Penstock Lagoon are microscope preparations, the two females from Great Lake are pinned and the remaining two females are in 2 per cent. formaldehyde solution.

This species has paler wings than *L. australica* (Enderlein), and the presence of cross-veins between Cu1 and the margin in the fore wing will help to separate it from that species.

### *Leptoperla exigua* sp.n.

FIG. 6

(In fluid.) Head and thorax brownish, abdomen paler, particularly beneath. Antennae long, brownish. Pronotum quadrate, about one-fifth broader than long, anterior angles rounded, anterior and posterior transverse furrows shallow. Legs yellowish-brown, femora with a darker ring just before apex, which is pale, base of tibiae also darker. Fore wing with apical cross-veins whitish, outer ones arranged in an almost straight row across the wing. In hind wing Rs and M separate close to base.

♂. Tenth tergite with its apical margin quadrately produced and deflexed; from a rounded whitish area arises a slender upcurved process, somewhat ridged dorsally. Supra-anal lobe long and slender, particularly in apical half, apex hooked downward. Cerci pale brownish, longer than abdomen, about thirty-two-segmented. Sub-anal plates upcurved, fitting closely on either side of the supra-anal lobe, apices dilated and terminating in an acute spine. Subgenital plate rather broad-oval, a small unpigmented area at its apex giving the appearance of being excised.

♀. Sides of the eighth and ninth tergites pigmented, dorsum membranous, tenth pigmented and triangularly produced. Sub-genital plate large, dark brown, apex shallowly excised, sides narrowly unpigmented, giving the appearance of a constriction

before the apex. Basally on each side is a shallow rounded depression. Sub-anal plates triangular, outer margins with a deep rounded excision. Cerci pale brownish, about as long as the abdomen.

Length of fore wing, ♂ 6·5 mm., ♀ 7 mm.

Length of hind wing, ♂ 5·5 mm., ♀ 6 mm.

W. AUSTRALIA: Kelmscott, 22.ix.1932, 2 ♂, 10 ♀, Bolgonup, 1.x.1932, 4 ♂, 2 ♀, (R. J. Tillyard); Chidlow, near Perth, 14.ix.1923, 3 ♂, 1 ♀, Mundaring, near Perth, 15.ix.1923, 1 ♀, (G. A. K. Marshall). TASMANIA: 1 ♂ (J. W. Evans).

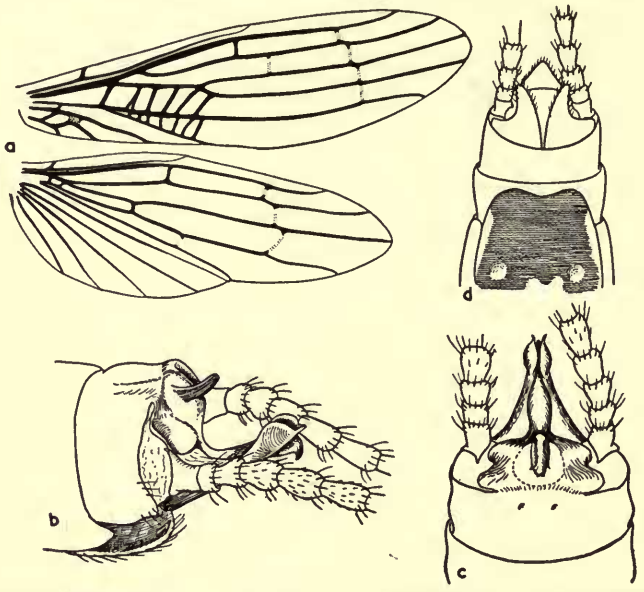


FIG. 6. *Leptoperla exigua* sp.n. *a*, wings ♂; *b–c*, genitalia ♂, *b*, dorso-lateral, *c*, dorsal; *d*, genitalia ♀, ventral.

Type male, paratype female from Kelmscott, paratype male from Chidlow as microscope preparations, others from Kelmscott and Bolgonup in 2 per cent. formaldehyde solution, remainder pinned.

In the single male from Tasmania the arrangement of cross-veins is not quite the same, but such differences as there are in genitalia are so slight that, in the absence of more material it is proposed to consider it as *L. exigua*.

### ***Leptoperla varia*** sp.n.

FIG. 7

(In fluid.) Head, thorax, and apex of abdomen brownish, remainder of abdomen whitish. Antennae long, brownish. Pronotum a little longer than broad, slightly narrowed anteriorly, with two broad transverse furrows, median line not well marked. Legs yellowish-brown, knees strongly banded with dark brown, apices of tibiae and tarsal segments brownish. Wings pale fuscous with darker venation. Fore wing largely pale at base, apical half with cross-veins pale, bordered with whitish, and

with numerous pale speckles. Hind wing uniform pale fuscous, except costal area and apical cross-veins, which are whitish. Rs and M separating close to base.

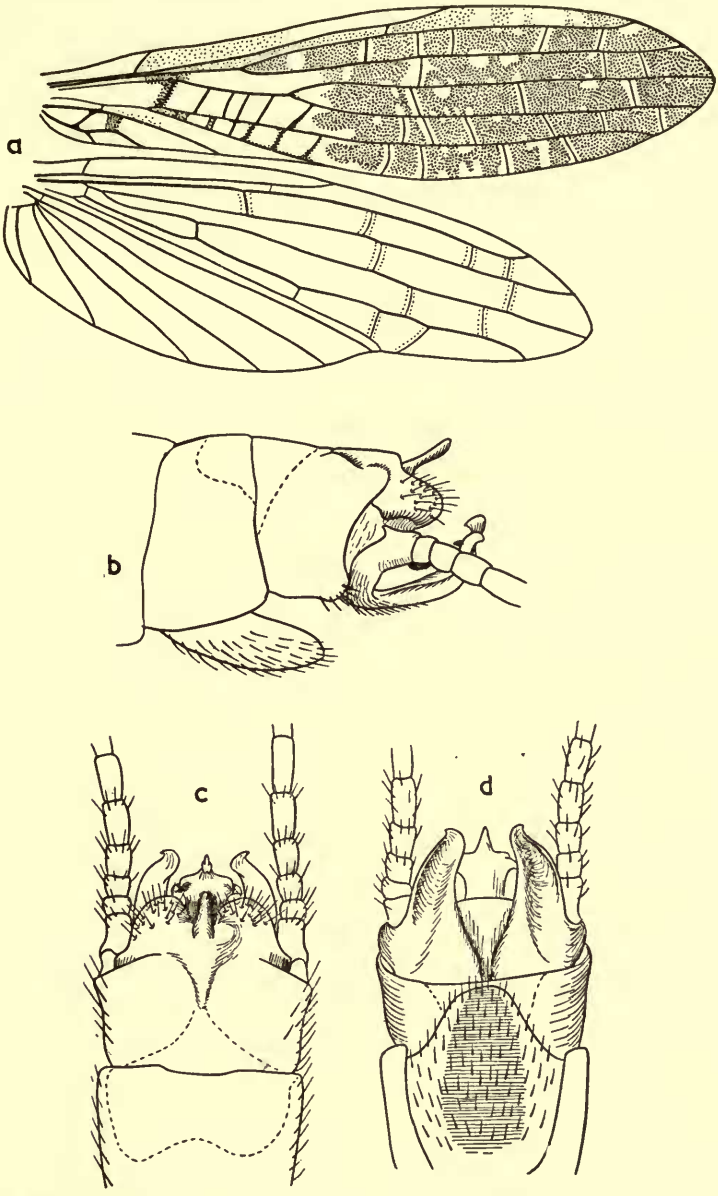


FIG. 7. *Leptoperla varia* sp.n. ♂. *a*, wings; genitalia, *b*, lateral, *c*, dorsal, *d*, ventral.

♂. Ninth tergite membranous dorsally, except at base. Tenth with a short median ridge, apical margin produced in two rounded lobes. The base of the excision between them is unpigmented and membranous, and from it arises a slender process, slightly dilated apically from side. Supra-anal lobe moderately broad at base,

its apex triangularly dilated and hooked, the two side angles each armed with a pair of hooks. Cerci brownish, at least as long as abdomen, about forty-five-segmented. Sub-anal plates broad at base, upcurved, hollowed on their lower surfaces, rather transparent, apices slightly hooked. Subgenital plate triangularly produced, apex rounded, a pigmented area down its centre making it appear narrower than it really is; it extends almost to the apex of the tenth sternite.

♀ (in the form of a microscope preparation from the Tillyard collection). Too distorted by pressure in mounting for description.

Length of fore wing ♂ 8 mm., ♀ 9·75 mm.

Length of hind wing ♂ 7 mm., ♀ 8 mm.

TASMANIA: Lake St. Clair, 6.ii.1933, 1 ♂, Scottsdale, 2.xi.1927, 1 ♂, 23.i.1933, 1 ♂, 1 ♀ (R. J. Tillyard).

Type male, Lake St. Clair, male and female paratypes in form of microscope preparations, one male paratype in 2 per cent. formaldehyde solution.

The speckled wings and bilobed tenth tergite of the male separate this species from any of the genus known to me.

### *Leptoperla rugosa* sp.n.

FIG. 8

(In fluid.) Head, thorax, and two terminal segments of abdomen brown, remainder of abdomen whitish, with small transverse brown sclerites, four on each tergite, three on each sternite, two anterior and a larger posterior one. Antennae slightly longer than fore wing, apices of segments more dilated than in *tasmanica*. Pronotum one-third broader than long, slightly narrowed anteriorly, posterior angles square, anterior rounded. Surface finely rugose or tuberculate, with deep anterior and posterior transverse furrows, linked by a fine median impressed line. Legs brownish, knees a little darker.

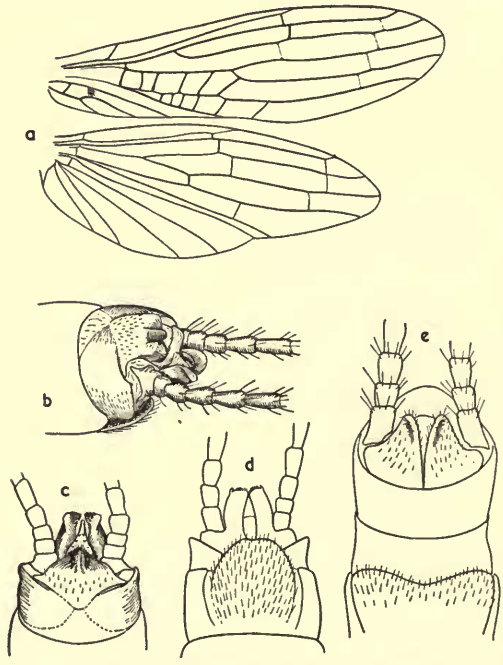


FIG. 8. *Leptoperla rugosa* sp.n. *a*, wings ♂; *b–d*, genitalia ♂, *b*, dorso-lateral, *c*, dorsal, *d*, ventral; *e*, genitalia ♀, ventral.

Wings moderately elongate, pale to medium fuscous, with darker veins. Both pairs generally with a narrow pale streak along apical half of costal area. Fore wing with three cross-veins below subcosta and four cross-veins in steps near the apex of the wing, one cross-vein between Cu1 and margin. In hind wing, Rs and M separate at some distance from base, about half-way to fork of M.

♂. Apical margin of tenth tergite deflexed, and bearing a short process, finger-like from the side, keeled dorsally. Supra-anal lobe upcurved, of medium width at base, tapering to a slender apex from above, upper lateral margins set with triangular teeth, a sinuous hooked projection on the ventral surface directed basally. Cerci brownish, longer than the abdomen, twenty-seven or more segments. Sub-anal plates broad, upcurving, apices truncate and setose, upper angles curving over outwards. Subgenital plate ovate, apex slightly flattened, sometimes slightly excised, extending beyond the bases of the sub-anal plates.

♀. Sides of segments eight and nine brownish, dorsum membranous; tenth tergite brownish, margin produced and rounded. Subgenital plate lightly chitinized, about the width of the segment and scarcely produced, its apex shallowly excised. Sub-anal plates triangular, apices rounded, not produced in long blades. Cerci brownish, about twice as long as the abdomen.

Length of fore wing, ♂ 7 mm., ♀ 7·75 mm.

Length of hind wing, ♂ 6 mm., ♀ 6·5 mm.

AUSTRALIA: Federal Capital Territory, Lee's Springs, xi.1932, 6 ♂, 1 ♀, Murrumbidgee River, i.1922, 1 ♂ (R. J. Tillyard); New South Wales, Bathurst, 2,300 ft., 10.xi.1884, 1 ♂ (from McLachlan collection).

Type male and one paratype male (from Lee's Springs) as microscope preparations, Bathurst male pinned, remainder in 2 per cent. formaldehyde solution.

The arrangement of the outer cross-veins of the fore wing in steps, anterior cross-veins nearer apex, seems reasonably constant, as does the position of separation of Rs and M in hind wing. The type and female paratype are rather paler than the others, probably due to the degree of maturity.

### *Leptoperla reticulata* sp.n.

FIG. 9

♂ unknown.

♀ (in fluid). Head yellowish-brown, marked with dark brown between the ocelli and on the occiput. Antennae brown, about 7 mm. long, a little shorter than the anterior wing. Pronotum dark fuscous, a little broader than long, narrowed anteriorly; a narrow, impressed, piceous median line linking similar anterior and posterior transverse lines. The latter do not extend more than half the width of the pronotum. Meso- and metanota shining piceous brown. Legs yellowish-brown, marked with dark brown at apices of femora, extending along posterior surface, bases and apices of tibiae and on the tarsi. Abdomen whitish above, except the tenth and sides of seventh to ninth tergites, which are fuscous, and the pale fuscous sternites of the first seven segments. Subgenital plate and centre of ninth sternite brown. Sub-anal plates light fuscous, margined exteriorly with dark brown. Wings rather short, pale greyish, with fuscous venation; membrane slightly clouded with brownish in costal area, around the pterostigma and bordering some of the cross-veins. In the fore wing, the most noticeable feature is the arrangement of the cross-veins in the apical half, where they tend to form an irregular network between the main veins. Cross-veins in apical half of hind wing normal.

Subgenital plate broad, only slightly produced; margin with a shallow excision, strongly pigmented. Ninth sternite with a small dark brown lobe at its centre, separated from the remainder of the sternite by notches in the apical margin. Sub-anal plates broad, apices stout, blunt and divergent. Cerci about 5 mm. long, twenty-six-segmented, yellowish-brown, moniliform at base, becoming filiform. Tenth tergite triangularly produced to a small rounded apex.

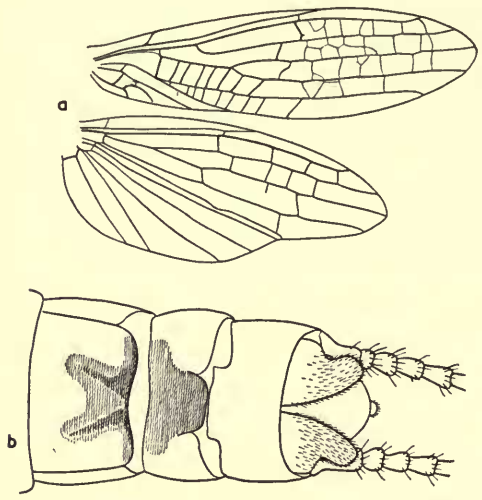


FIG. 9. *Leptoperla reticulata* sp.n. ♀. *a*, wings, *b*, genitalia, ventral.

Length of fore wing, 8·5 mm., of hind wing, 7·25 mm.

AUSTRALIA: New South Wales, Mt. Kosciusko, Spencer's Creek, xii.1932, 1 ♀ (R. J. Tillyard).

Type in form of microscope preparation.

This species should be easily separable from other described species by the irregular reticulation of the fore wing, and by the lobe of the ninth sternite.

### *Leptoperla nigrifrons* sp.n.

FIG. 10

♂ (in fluid). Head dark brown, pitchy-black between epicranial suture and labrum; antennae brown, basal segment blackish above. Pronotum brown, with blackish rugosities, median line, anterior and posterior furrows blackish; quadrate, parallel-sided, about as long as broad, anterior margin slightly convex, anterior angles rounded. Meso- and metanota brown. Legs brown, femora blackish. Wings hyaline, with considerable pale brownish suffusion as in Fig. 10; venation brownish, apical cross-veins rather weak. In posterior wing the stalk of Rs+M is rather long, there are two or three cross-veins between Cu1 and Cu2, and the angle between the posterior margin and the anal fan is rather abrupt. Abdomen and cerci brownish. Ninth tergite somewhat excised and membranous at the centre of its apical margin. Ninth sternite moderately produced in a parallel-sided subgenital plate, whose apex in ventral view is rounded, with a shallow median excision. Tenth tergite small, dorsally almost divided into two lobes by excisions of the apical and basal margins. Supra-anal lobe broad at base, in dorsal view with a finger-like process arising from an elevated trapezoidal base; below this the lobe is bent downward and tailward. About midway on the upper surface is a small basally-directed hook, and the lobe terminates in a downturned hook. Cerci long, slender, with more than thirty segments (incomplete), which become progressively longer and more slender towards the apex. The second segment is obliquely truncate, causing the cerci to be angled in dorsal view. Sub-anal plates upcurved in side view, gradually dilating to a truncate apex, with a pointed upper angle. In ventral view they are slender, with out-turned apices.

Length of fore wing, 8 mm.

TASMANIA (J. W. Evans), 2 ♂.

Type male in form of microscope preparation, paratype in 2 per cent. formaldehyde solution.

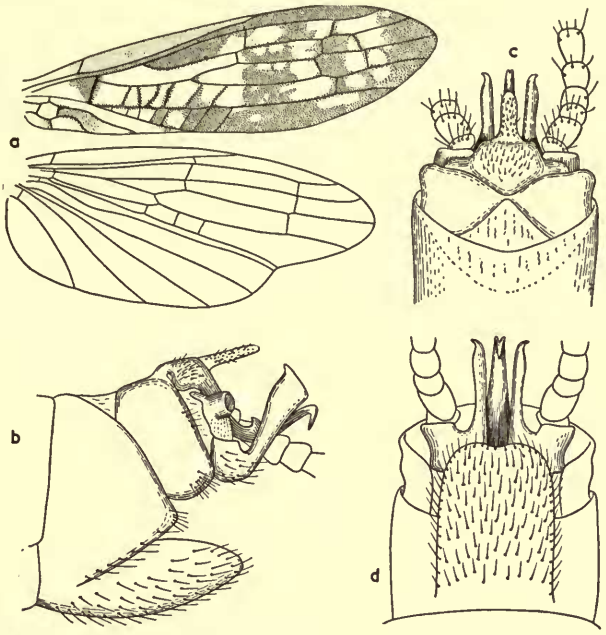


FIG. 10. *Leptoperla nigrifrons* sp.n. ♂. *a*, wings, showing pattern of fore wing; *b*, genitalia, lateral (left cercus omitted), *c*, genitalia, dorsal, *d*, the same, ventral.

The venation of the posterior wing suggests that this species be grouped with *L. rugosa* and *L. reticulata*, but it may be separated from them by the pattern of the fore wing and the shape of the anal fan.

### ***Leptoperla*** sp. No. 1

FIGS. 11–13

Nymph (? about half-grown). General colour yellowish-brown, with obscure, slightly darker markings; of rather slender build (about 7 mm. long), legs rather stout. Body sparsely clothed with short hairs, and in some areas very short, stout spinules. Head rather wider than the pronotum, brownish, smooth, developing ocelli visible as black spots beneath the integument. Antennae incomplete, fairly stout, tapering towards apex: first segment large, second smaller, but still larger than any of the next few succeeding ones; a few scattered setae, but no dorsal fringe.

Labrum about twice as broad as long, anterior angles rounded. Labium with glossae a little shorter than paraglossae, about the same width, with an apical tuft of setae; excision between glossae very narrow. Paraglossae pointed, inner margins straight, outer rounded. Labial palpus three-segmented, terminal segment large, ovate, as long as first and second together. Maxilla well developed: lacinia with three

or four blunt plate-like teeth at its apex and near them, on its inner margin, a row of strong acute setae. Galea about as long as lacinia, tapering to a setose apex. Palpus five-segmented, first, second, and fourth short, second half as long again as the first, third twice as long as the first, fourth equal to the second, and fifth a little longer than first and second. Mandibles strongly chitinized, with a number of acute teeth near apex.

Pronotum about as long as broad, slightly narrowed in front, angles rounded, anterior and posterior margins both somewhat convex; median impressed line about half as long as pronotum, anterior and posterior impressed lines present, angled towards each other at their centres. Surface of pronotum smooth. Wing pads small, anterior elongate, posterior triangular; venation typical of the genus. Mesonotum with an irregular row of small spinules along the anterior margin and over base of wing pad. Posterior margins of meso- and metanota produced backward, plate-like, a narrow incision separating their lateral angles from the wing pads.

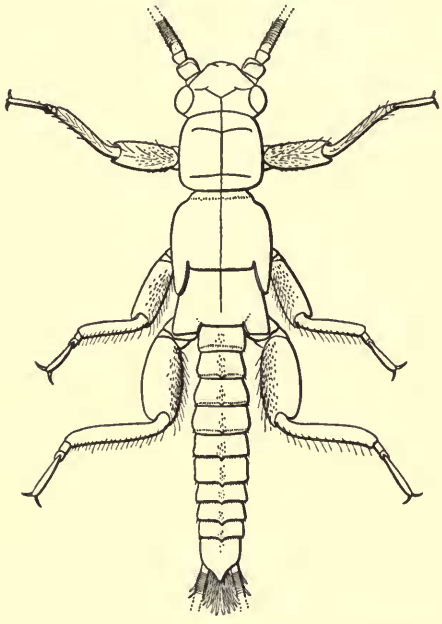

FIG. 11. *Leptoperla* sp. No. 1. Nymph.

Legs short and strong, yellowish-brown, femora dorsally with short spinules and setae, rather deep; tibiae a little longer than femora, with short acute spinules on inner surfaces, and a sparse row of fine setae exteriorly. First tarsal segment short, second very short, third about three times as long as first.

Abdomen cylindrical, tergites two to nine elevated along the median line, apical margin of each produced in a short spur. This elevated area and the apical margin bears short spinules as well as hairs, sternites bearing hairs only. Margin of tenth tergite triangularly produced. Anal gills dull whitish. Cerci incomplete. Sub-anal plates broad, spatulate.

TASMANIA: Scottsdale, Cuckoo Falls Creek, 31.vii.1931 (R. J. Tillyard). Five examples, probably all males; it is possible that these nymphs may belong to the species *L. varia* Kimmins, which occurs in this locality. The somewhat irregular arrangement of the cross-veins in the nymphal fore wing suggests this, but further confirmation is needed.

### ***Leptoperla*** sp. No. 2

FIGS. 12–13

Full-grown male nymph. General colour fuscous, of slender build, with rather short legs: length about 6 mm. Body smooth, sparsely clothed with short setae, whose apices are slender and curled. Head about as wide as pronotum, antennae incomplete, moderately stout, tapering.

Labrum about twice as broad as long, anterior angles rounded. Labium with glossae a little shorter and narrower than paraglossae, with an apical tuft of setae. Paraglossae less pointed than in sp. No. 1. Labial palpus rather stouter than in sp. No. 1; maxillae with palpus rather stouter, mandibles similar.

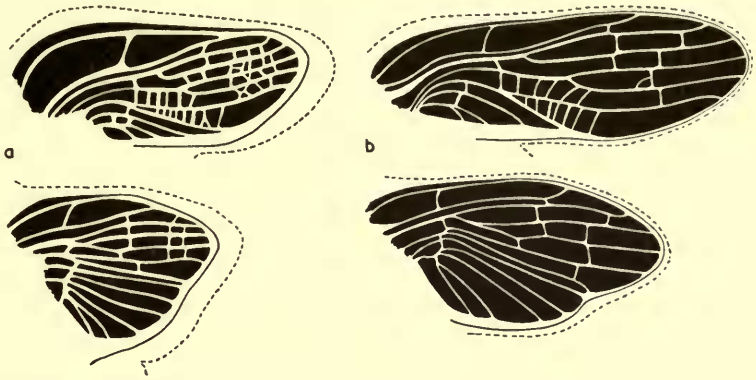


FIG. 12. *Leptoperla* spp. Nymphal venation. *a*, sp. No. 1; *b*, sp. No. 2.

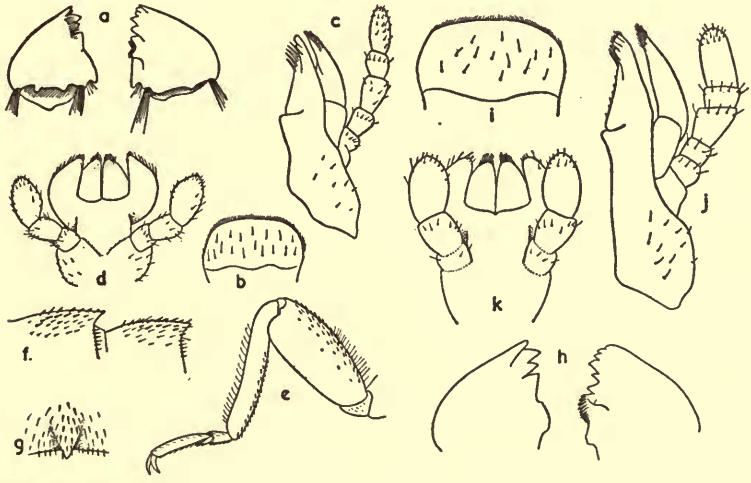


FIG. 13. *Leptoperla* spp. Nymphal structures. *a–g*, sp. No. 1; *h–k*, sp. No. 2. *a*, mandibles; *b*, labrum; *c*, maxilla; *d*, labium; *e*, leg; *f*, dorsal armature of abdominal tergites, lateral; *g*, the same, dorsal; *h*, mandibles; *i*, labrum; *j*, maxilla; *k*, labium.

Pronotum broader than long, somewhat narrowed anteriorly, angles rounded, margins straight. Strong median and transverse impressed lines, anterior shorter than posterior, both angled towards each other at their centres. Wing pads of medium size, anterior elongate, overlapping basal two-thirds of posterior; fuscous, with longitudinal veins slightly darker. Imaginal venation less distinct than in some species, few cross-veins in apical half of wings. No incision between anal angle of wings and nota.

Legs paler than body, similar to sp. No. 1, but with rather fewer short setae. Abdomen long, cylindrical, somewhat ridged along dorsum, apical margins not

produced. Tenth tergite much elevated in a median dorsal ridge, terminating in an acute finger, projecting beyond the triangularly produced margin. Basal margin with a pair of acute triangular apodemes. Anal gills pale pinkish, cerci incomplete. Sub-anal plates about twice as long as broad, parallel-sided for most of their length, tapering near apex.

TASMANIA: Scottsdale, a number of male nymphs.

Smaller than sp. No. 1, rather more slender; pronotum is definitely broader in proportion to its length, and tenth tergite is more produced; sub-anal plates narrower.

## *DINOTOPERLA* Tillyard

*Dinotoperla* Tillyard, 1921, *Canad. Ent.* **53:** 43, fig. 4*b*.
Type species: *Perla opposita* Walker, 1852 (fixed by Tillyard, 1921).
Tillyard, 1921, *Trans. Roy. Soc. S. Aust.* **45:** 270–273, figs. 2–3.

Fore wing with Rs simple, M forked from near the middle of wing, Cu1 forked; a thickened cross-vein between 1A and 2A; cubito-anal space with a basal cross-vein only. Hind wing with Rs simple; M and Rs separating some distance from base; M forked, posterior branch fused for a space with Cu1, separating again before the margin of the wing; generally only one cross-vein between the branches of cubitus. Anal fan rather narrow. Cerci shorter than abdomen.

*Distribution*: Australia, Tasmania.

### *Dinotoperla serricauda* sp.n.

FIG. 14

Head, thorax, and apex of abdomen brown, segments one to eight of abdomen whitish. Eyes blackish, antennae brown, about as long as fore wing, basal segment enlarged. Pronotum almost rectangular, broader than long, slightly narrowed anteriorly. Legs brownish, slightly darker at the knees. Wings pale fuscous, with darker venation; in anterior, R, Rs, and most cross-veins broadly shaded with darker fuscous. Veins in hind wing not shaded.

♂. Apical margin of tenth tergite produced at its centre in a pale process, triangular and acute from the side; from above broad and pigmented at its base, tapering to a narrow, rounded apex, upper surface closely set with minute setae. Supra-anal lobe projecting beyond apex of tergite, slender and blade-like from above, apex abruptly hooked downwards. Cerci brownish, about 1¼ mm. long, eleven-segmented, tapering slightly, segments near base shorter than broad, slightly serrately produced on inner surfaces. Sub-anal plates scimitar-like, apices somewhat incurved; from beneath, they are seen to arise from broad bases and are contiguous for most of their length. Margin of ninth sternite produced in a parabolic subgenital plate about as long as its sternite, from side appearing as a stout, blunt finger.

♀. Wings more elongate. Subgenital plate of eighth sternite very short and broad, scarcely projecting beyond the margin. Sub-anal plates triangular, from beneath apices produced in slender fingers: near the upper basal angle is a small, rounded, whitish pit. Cerci less serrate than in male, twelve-segmented. Margin of tergite produced, rounded and bent down, whitish, with minute setae as in male.

Length of fore wing, ♂ 9·5 mm., ♀ 11 mm.

Length of hind wing, ♂ 8·5 mm., ♀ 9·5 mm.

TASMANIA: R. Ouse, 4.ii.1933, 4 ♂, 2 ♀ (R. J. Tillyard); Deloraine, 20.xii.1884, 1 ♀.

Type male (R. Ouse) in form of microscope preparation, 3 ♂, 2 ♀ paratypes in 2 per cent. formaldehyde solution, 1 ♀ paratype from Deloraine, pinned.

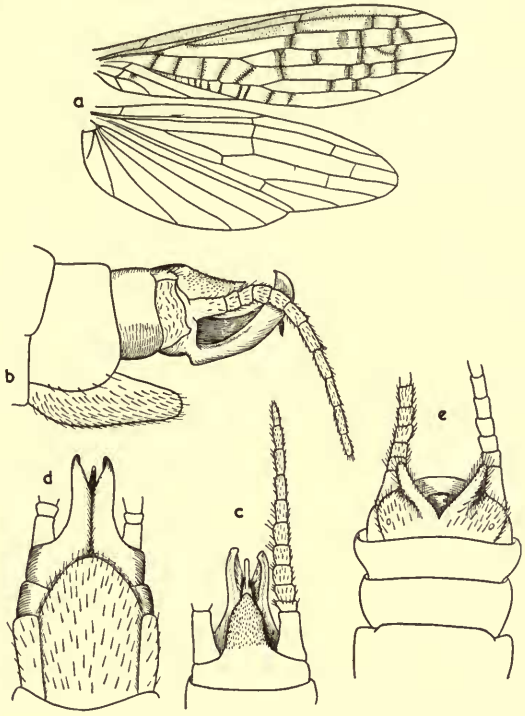


FIG. 14. *Dinotoperla serricauda* sp.n. *a*, wings ♂; *b–d*, genitalia ♂, *b*, lateral, *c*, dorsal, *d*, ventral; *e*, genitalia ♀, ventral.

Compared with *D. carpenteri* Tillyard, in fore wing the posterior margin between Cu2 and Cu1*b* is more bowed, and Cu1*b* is longer. In the hind wing, the anal fan is broader. Tillyard's figure does not permit of a useful comparison of the male genitalia.

### ***Dinotoperla opposita*** (Walker)

FIG. 15

*Perla* (sg. *Chloroperla*) *opposita* Walker, 1852, *Cat. Neur. Ins. B.M.* **1:** 171.

*Leptoperla opposita* McLachlan, 1874, *Trans. N.Z. Inst.* **6** (Append.): xcii; Banks, 1913, *Trans. Amer. Ent. Soc.* **39:** 203.

*Dinotoperla opposita* Tillyard, 1921, *Canad. Ent.* **53:** 43; id., 1923, *Trans. N.Z. Inst.* **54:** 203.

Walker described the species as follows:

'100. PERLA OPPOSITA.

'Nigra, nitens, ferrugineo varia; caput antice testaceum, thorace vix latius; prothorace antice non latius, disco ruguloso, lateribus marginatis rectis, angulis sat acutis; scutellum flavo maculatum; alae subcinereae, ad venas transversus obscuriores.

'Black, shining, partly ferruginous: head testaceous in front, hardly broader than the thorax: antennae very minutely pubescent: prothorax minutely punctured, rugulose on the disc, not broader in front, with a rim on each side and along the fore-border; sides straight, angles rather sharp: scutellum with a yellow spot in front: wings very slightly gray, darker about the transverse veins: veins black. Length of the body 4½ lines, of the wings 13 lines.[1]

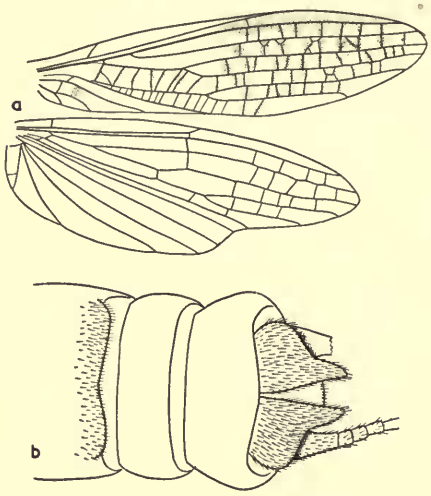


FIG. 15. *Dinotoperla opposita* (Walker) ♀. *a*, wings; *b*, genitalia, ventral.

'*a, b.* Van Diemen's Land. From Dr. Hooker's collection.

'*c.* Van Diemen's Land. From Mr. Smith's collection.

'*d.* New Zealand. Presented by Capt. J. C. Ross.'

The New Zealand specimen and one of Dr. Hooker's examples can no longer be traced in the British Museum collection. McLachlan and Tillyard, however, were both of the opinion that Walker's *opposita* does not occur in New Zealand, and that the record was based on a mis-identification. This is very probable, as there is a strong superficial resemblance between species of different genera in the Gripopterygidae.

To Walker's description may be added that the two remaining examples are females, one with the abdomen damaged by insects. The pronotum is broader than long, anterior margin rounded, making anterior angles obtuse. The subgenital plate is scarcely produced, broad, slightly emarginate at its centre, not or but slightly pigmented. Sub-anal plates broad, triangular, outer margins obtusely excised, apices broader and less divergent than in *D. serricauda* Kimmins. Cerci short, thirteen-segmented (damaged and possibly incomplete in type). Tenth tergite produced in a rounded, deflexed lobe.

Wings a little more pointed than in *serricauda* Kimmins, and with more numerous cross-veins in the apical half.

I have selected as type the female from Mr. Smith's collection, labelled V.D.L., 51.153; the abdomen has been made into a microscope preparation and one pair of wings has been mounted dry on a microscope slide.

I have seen no more examples of this species, which is seemingly restricted to Tasmania. Tillyard records it from Mt. Wellington, Hobart.

### ***Dinotoperla fontana*** sp.n.

FIG. 16

(In fluid.) Head, thorax, and abdomen brownish, the latter with apices of segments whitish, whitish areas becoming progressively narrower from base to apex.

[1] The wing measurement is obviously the expanse, not the length.

Eyes blackish, antennae brown, about as long as fore wing. Pronotum about three-fifths as long as broad, narrowed anteriorly, anterior and posterior transverse furrows strong, linked by a narrow median line and somewhat shallow lateral troughs. Legs yellowish-brown, knees and tarsi somewhat darker; ventral surface of femora with a pair of dark brown lines.

Wings yellowish fuscous, veins slightly darker. In fore wing, cross-veins in apical half numerous (more than twenty), not very strong, in dark specimens faintly bordered with brownish. In hind wing, Rs and M separate at some distance from the base.

♂. Apical margin of tenth tergite produced at its centre in a pale process, cylindrical, and tapering to an acute apex, which is more slender than in *serricauda*; its upper surface clothed with minute setae. At its base are two chitinous ribs supporting the supra-anal lobe. The latter is slender, its apex laterally compressed, from the side dilated, upper angle rounded, lower hooked. Cerci brownish, bent downwards, a little over 1 mm. in length, ten-segmented, segments becoming narrower and longer towards the apex. Sub-anal plates blade-like, upcurved, outer surface with two or three weak, transverse corrugations. Subgenital plate dark brown, parabolic, extending to bases of sub-anal plates.

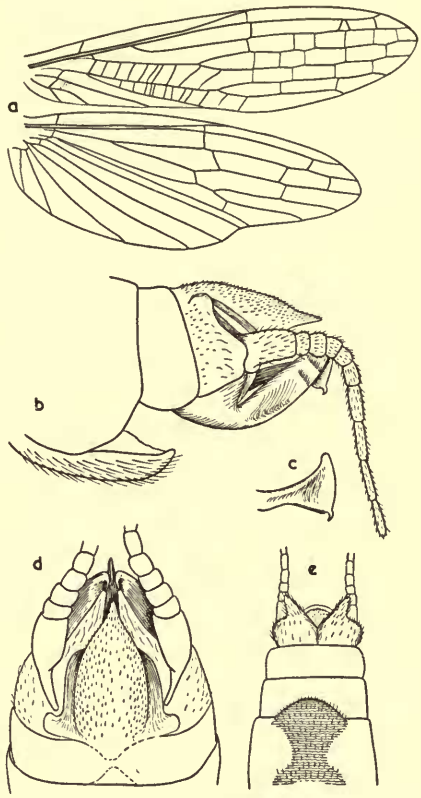


FIG. 16. *Dinotoperla fontana* sp.n. *a*, wings ♂; *b–d*, genitalia ♂, *b*, lateral, *c*, apex of supra-anal lobe, lateral, *d*, dorsal; *e*, genitalia ♀, ventral.

♀. Pronotum more rugose than in male. Abdomen almost wholly pale except tenth, part of ninth segments, and the subgenital plate. The latter is produced in a broad parabola, about half the width of the sternite; the plate is strongly pigmented, extending to base of segment, the pigmentation constricted about midway. Sub-anal plates broad, apices acute and divergent. Cerci brownish, twelve-segmented. Tenth tergite pigmented basally, apical margin pale, the basal pigmentation extending in a narrow finger into the produced part.

Length of fore wing, ♂ 10·5 mm., ♀ 9 mm.

Length of hind wing, ♂ 9·5 mm., ♀ 8 mm.

AUSTRALIA: Federal Capital Territory, Lee's Springs, xi.1932, 3 ♂, 1 ♀; New South Wales, Mt. Kosciusko, 10–15.xii.1934, 1 ♀ (R. J. Tillyard).

Type male, paratype female (Lee's Springs) in microscope preparations, remainder in 2 per cent. formaldehyde solution.

The form of the supra-anal lobe and the more produced tenth tergite in the male,

and the more produced and pigmented subgenital plate of the female will separate this species from *D. serricauda* Kimmins and *D. carpenteri* Tillyard.

### *Dinotoperla carpenteri* Tillyard

FIG. 17

*Dinotoperla carpenteri* Tillyard, 1921, *Trans. Roy. Soc. S. Aust.* **45:** 273–274, figs. 1–4.

I have been unable to recognize this species with certainty amongst the British Museum material, and as I am unable at present to study the type, I am repeating Tillyard's description and figures. His illustration of the male genitalia is difficult to

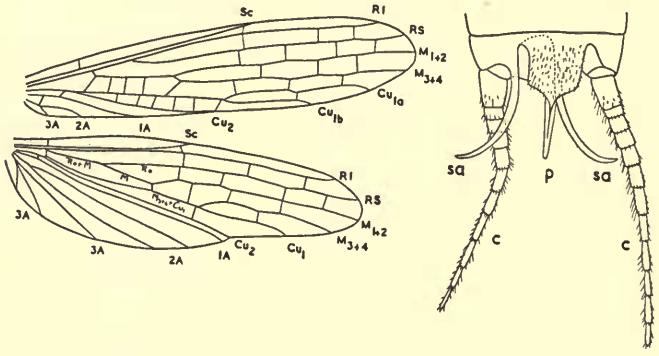


FIG. 17. *Dinotoperla carpenteri* Tillyard ♂. Wings and genitalia (after Tillyard). *c*, cerci, *p*, 'penis', *sa*, 'superior appendages', probably in dorsal view.

understand; it was made from a microscope preparation and one which appears to have been much flattened in mounting. Tillyard says it is a ventral view, but the median lobe bears considerable resemblance to the supra-anal lobe of *Dinotoperla* and one of the sub-anal plates (*superior appendages*) passes beneath it. The other one is drawn above the cercus, thus apparently being in ventral aspect. It is probable that in drawing from a flattened mount, Tillyard was mistaken in the relative position of the various parts. Under the circumstances I have considered it wiser not to attempt to re-figure the species from an example which might not be correctly determined, but to leave the elucidation of this species to an Australian or New Zealand entomologist who has access to the type.

'*Forewing*, 10 mm. *Expanse*, 21·5 mm.

'Head, thorax and abdomen dull blackish, touched with dark brown behind the eyes and on notum. *Eyes* brownish-black. *Antennae* about as long as the forewing, very slender, about 50 segments, the basal one slightly enlarged. *Pronotum* rectangular, broader than long. *Legs* dull brownish, the apices of the femora and tibiae darkened; the tarsi darker, except at base of first segment. *Cerci* rather short, 10- to 11-segmented, tapering, delicately haired, the basal segment thickest and much longer than any of the next few succeeding segments. In the male, the *superior appendages* are slender, elongated, curved processes, projecting on either side of the penis, the basal portion of which is a broad plate, the distal portion slender and

upcurved. In the female, the ventral plate is deeply bifid, a deep triangular notch dividing it into two triangular pieces.

'Wings: Forewing medium fuscous, with irregular paler sub-hyaline spaces between the cross-veins; i.e., each cross-vein is surrounded by a rectangle of the fuscous ground-colour, and the spaces between these rectangles are paler. As the positions and number of these cross-veins is inconstant, varying for each individual, the pattern thus produced is very irregular, and is never very conspicuous. *Hindwing* a uniform medium fuscous. When at rest, the dark and pale areas of the two wings appear to re-inforce each other, giving the insect a distinctly banded appearance.

'Locality: Hornsby, near Sydney, N.S.W. Bred from larvae found on rocks in a small stream in Old Man's Valley; also found sitting about on the stems of reeds and grasses near the stream. July to October.

'Types: Holotype (Hornsby, Sept. 14, 1917, R. J. T.) and series of paratypes in Tillyard collection, Cawthron Institute, Nelson, N.Z.

'The set specimens have the abdomens so shrivelled that it is impossible to determine the sex or study the sexual appendages. The descriptions of these organs given above were made from slides prepared from specimens of the paratype material.'

### ***Dinotoperla brevipennis*** sp.n.

FIG. 18

Head and pronotum light yellowish-brown, with considerable darker brown markings; remainder of thorax brown. Antennae brown, a little shorter than fore wings. Pronotum quadrate, two-thirds as long as broad, surface finely rugulose or granulose, posterior angles obtuse. Legs brownish, knees and two lines on lower surface of femora darker. Abdomen largely brownish above, paler beneath. Wings short, extending only to apex of abdomen, light fuscous (hind wing darker), with darker venation. In fore wing, apical cross-veins pale, all cross-veins bordered with brownish.

♂. Apical margin of tenth tergite produced at its centre in a pale process, shorter than in *serricauda*, apex rounded, not acute; upper surface finely setose. Supra-anal lobe short, laterally compressed, and blade-like, its apex from the side expanded and produced downward in a hook. Cerci brownish, bent downward, about 1 mm. in length,

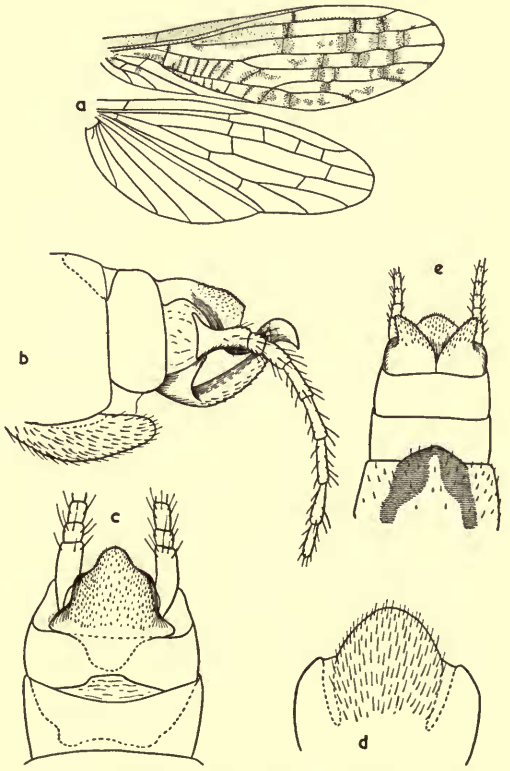


FIG. 18. *Dinotoperla brevipennis* sp.n. *a*, wings ♂; *b–d*, genitalia ♂, *b*, lateral, *c*, dorsal, *d*, sub-genital plate, ventral; *e*, genitalia ♀, ventral.

nine- or ten-segmented, those beyond the fifth of about equal length. Sub-anal plates blade-like, upcurved, with acute apices. Subgenital plate dark brown, parabolic, extending to bases of anal plates.

♀. Abdomen whitish, except tenth segment, subgenital plate and ninth tergite, which are brown. Sternites two to seven with four tiny brownish plates. Subgenital plate rather less produced than in *D. fontana* Kimmins, about half the width of the segment. It is strongly pigmented, rather broader at base than apex, and with a large hyaline area at the base, extending in a narrow finger almost to apex. Sub-anal plates broad, apices divergent, rather stouter than in *fontana*. Cerci brownish, about nine-segmented. Tenth tergite roundly produced at its centre, apical margin narrowly whitish.

Length of fore wing, ♂ 5 mm., ♀ 5·5 mm

Length of hind wing, ♂ 4·2 mm., ♀ 4·6 mm.

AUSTRALIA: New South Wales, Bolaro, 22.xii.1935, 3 ♂, 6 ♀; Rule's Point, 4,450 ft., 30.xii.1934, 2 ♂ (R. J. Tillyard).

Type male, paratype female from Bolaro, in form of microscope preparations, remainder in 2 per cent. formaldehyde solution.

### ***Dinotoperla thwaitesi*** sp.n.

FIG. 19 *a–c*

♂ (dried). Resembling *D. brevipennis* Kimmins but with longer wings and differences in genital structure. Head and pronotum light brownish, with considerable darker markings. Antennae brown, incomplete. Pronotum quadrate, about three-fourths as long as broad, median line short, angles obtusely rounded. Meso- and metanota dark brown. Legs brownish, darker at knees and with darker lines beneath femora. Abdomen brownish above, paler beneath, particularly towards base. Wings more elongate than in *brevipennis*, and with more numerous apical cross-veins. In hind wing, anal fan is flatter and less evenly rounded; point of separation of M3+4 and Cu1 before intercubital cross-vein. Wings brownish (hind darker), venation brown and most of cross-veins bordered with brownish.

Apical margin of tenth tergite scarcely produced, membranous at its centre. Supra-anal lobe slender from above, rather longer than in *brevipennis*, from side sinuous and terminating in an acute down-turned hook. Cerci brownish, bent downwards, about 1·5 mm. long, twelve-segmented, more finely haired than in *brevipennis*. Sub-anal plates blade-like, acute, upcurved, rather broader about midway. Subgenital plate dark brown, narrower and more pointed than in *brevipennis*.

Length of fore wing 9 mm., of hind wing 8 mm.

AUSTRALIA: Victoria, Melbourne (Thwaites), 1 ♂.

Type (with abdomen mounted in balsam) in collection of Hope Department, University Museum, Oxford.

### ***Dinotoperla uniformis*** sp.n.

FIG. 19 *d–g*

♂ (in fluid). Head, thorax, antennae, and legs pale brownish, head and thorax with obscure, slightly paler markings, abdomen whitish, ninth and tenth segments

pale brownish. Antennae about as long as fore wing. Pronotum a little broader than long, narrowed anteriorly, transverse furrows distinct, lateral margins slightly raised, a narrow median impressed line. Legs practically without markings, either at knees or beneath femora. Wings pale fuscous, veins darker, a few paler areas in fore wing. Ten to twelve rather weak cross-veins in apical half of fore wing. In hind wing, Rs and M separate some distance from base.

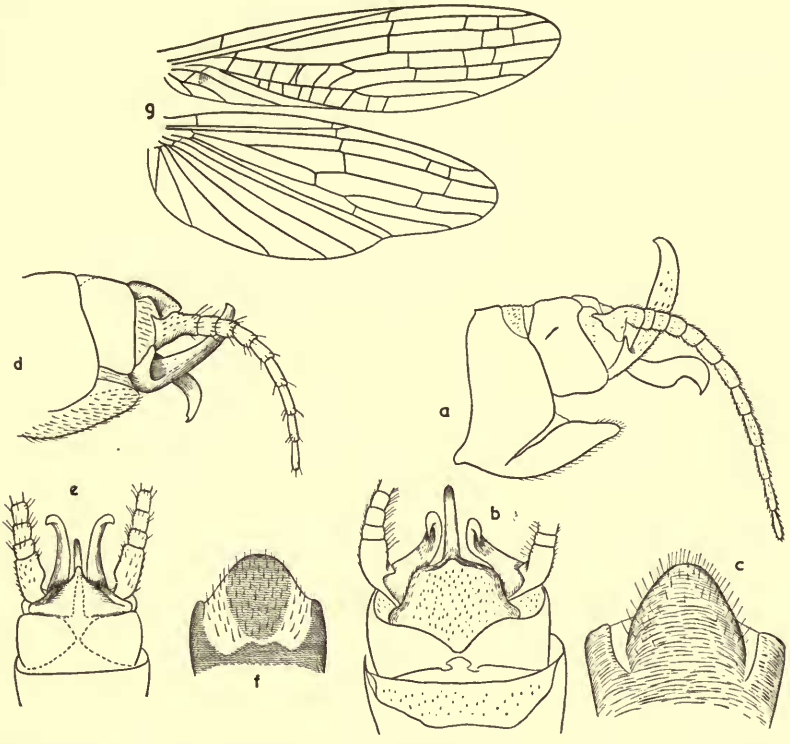


FIG. 19. *Dinotoperla* spp.n. ♂. *a–c, D. thwaitesi; d–g, D. uniformis.* Genitalia, *a*, lateral; *b*, dorsal; *c*, subgenital plate, ventral; *d*, lateral; *e*, dorsal; *f*, subgenital plate, ventral; *g*, wings.

Tenth tergite from above triangularly produced at its centre, pale brownish, only its extreme apex and a narrow median area whitish. From the side it is much less produced than in the other species. Supra-anal lobe slender, down-curved towards its apex, which is acute, and excised on its lower surface. Cerci pale brownish, bent downwards, about 1 mm. in length, ten-segmented. Sub-anal plates slender, upcurved, apices acute and divergent. Subgenital plate produced and rounded, an ovate pigmented patch at its centre.

♀ unknown.

Length of fore wing 9 mm., of hind wing 8 mm.

AUSTRALIA: New South Wales, Rule's Point, 4,450 ft., 30.xii.1934, 1 ♂ (R. J. Tillyard).

Type in form of microscope preparation.

### *Dinotoperla evansi* sp.n.

FIGS. 20 *a–c*, 21 *a*

♂ (in fluid). Head and thorax light reddish-brown. Head practically without markings, antennae long, reddish-brown, basal segment dark brown. Pronotum broader than long, slightly narrowed anteriorly, sides straight, anterior margin slightly produced and rounded; anterior and posterior transverse furrows distinct. Colour reddish-brown, with a median longitudinal streak of yellowish-brown. Meso- and metanota reddish-brown. Legs light reddish-brown, knees darker and two dark lines on ventral surface of each femur and one on each tibia. Abdomen with segments

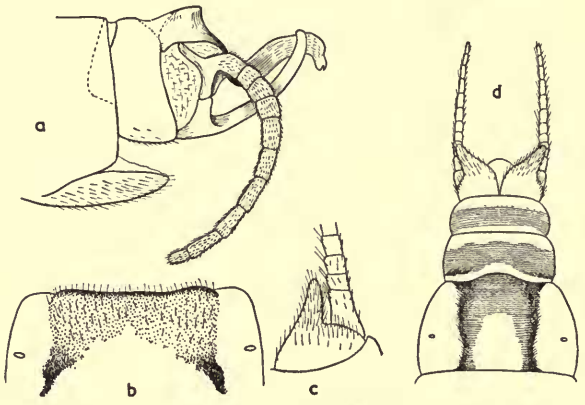


FIG. 20. *Dinotoperla* spp.n. *a–c*, *D. evansi*; *d*, *D. nigricoxa*. *a*, ♂ lateral; *b*, ♀ subgenital plate, ventral; *c*, ♀ sub-anal plate, ventral; *d*, genitalia ♀, ventral.

one to five whitish, remainder largely dark brown. Wings smoky-brownish (hind wings the darker) with darker venation, costal and stigmal areas darker; apical cross-veins pale, in fore wings bordered with brownish.

Apical margin of tenth tergite elevated, but without a pale, produced process, its place being taken by a flat membranous area. Supra-anal lobe rather long, compressed laterally, apex curved downward, rounded, and carrying a small hook. Cerci brownish, bent downward, rather more than 1 mm. in length, about ten-segmented. Sub-anal plates blade-like, upcurved, with rounded apices. Subgenital plate dark brown, rather narrow, with a very flatly rounded apex.

♀. General appearance similar, wings rather darker; abdomen with only segments nine and ten, subgenital plate, sub-anal plates, and cerci dark brown. Subgenital plate broad, not produced, pigmented area with a broad triangular excision at base. Sub-anal plates with slender produced apices. Cerci slender, about thirteen segments.

Length of fore wing, ♂ 10·5 mm., ♀ 10·5 mm.

Length of hind wing, ♂ 9 mm., ♀ 9 mm.

S. AUSTRALIA: Mt. Lofty, x.1931, 1 ♂ (J. Evans); Cudlee Creek, 20.xi.1934, 6 ♀ (R. J. Tillyard); Adelaide, 2 ♀ (Hope Dept., Univ. Mus., Oxford).

Type male, paratype female in form of microscope preparations, others in 2 per cent. formaldehyde solution, females from Adelaide pinned.

This species resembles *D. uniformis*, but may be distinguished by the form of the supra-anal lobe and subgenital plate in the male, and by the venation. One of the females from Adelaide is larger than those from Cudlee Creek (fore wing, 11·5 mm.) and has more numerous apical cross-veins, but the form and pigmentation is similar.

### ***Dinotoperla fusca*** sp.n.

FIG. 21 *b*, *c*

♂ unknown.

♀ (in fluid). Head fuscous, with darker markings near antennal bases and behind epicranial sutures. Antennae fuscous, with blackish basal segment. Pronotum fuscous, anterior and posterior margins finely bordered with blackish-brown, and

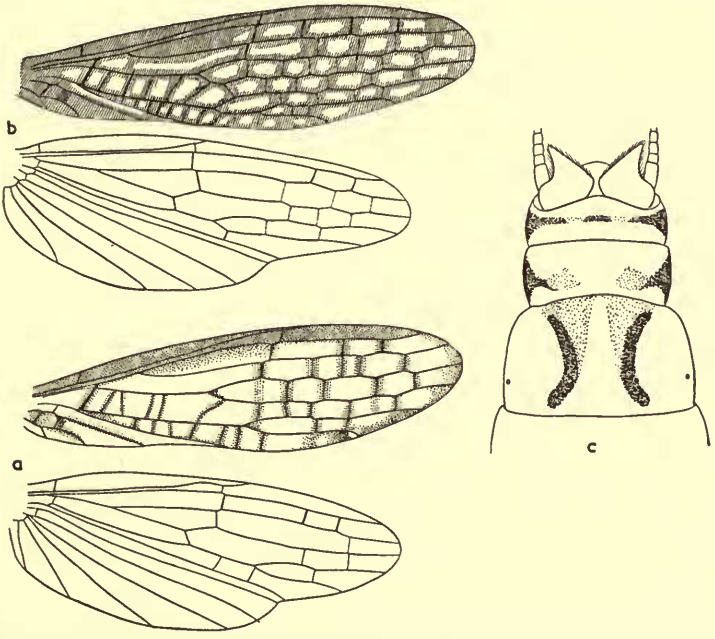


FIG. 21. *Dinotoperla* spp.n. ♀. *a*, *D. evansi* wings; *b*, *D. fusca* wings; *c*, *D. fusca* genitalia, ventral.

with blackish rugosities on the disk; quadrate, broader than long, anterior and posterior transverse furrows rather broad. Meso- and metanota dark brown. Femora yellowish-brown, ventral carinae and apical third of femur dark brown, tibiae and tarsi dark brown. Wings brownish hyaline, anterior with whitish areas in most of the apical, medio-cubital, and cubital cellules. Venation brownish, many of the apical cross-veins weak and whitish, those in the anterior wing numerous. Abdomen whitish, pattern of subgenital plate and parts of the ninth and tenth segments, and cerci brownish-black. Eighth sternite forming a subgenital plate whose margin is only very slightly produced. There is a strongly pigmented pattern resembling that in *D. evansi*, but the pigmented area is much longer than broad, the lateral margins

are more concave and the pale median area is narrower and extends to the apex. Pigmentation of the ninth sternite interrupted centrally, of tenth complete. Sub-anal plates broad, subtriangular, outer margins concave, inner straight. Cerci short, about eleven-segmented.

Length of fore wing 10·5 mm., of hind wing 9·5 mm.

TASMANIA (J. W. Evans), 2 ♀.

Type in form of microscope preparation, paratype in 2 per cent. formaldehyde solution.

This species resembles *D. evansi* and *D. nigricoxa* in the pattern of the female sub-genital plate. From the former it may be separated by the rather more pointed wings and different pattern. In *nigricoxa* the wings are almost without pattern and there are far fewer apical cross-veins.

### ***Dinotoperla nigricoxa*** sp.n.

FIG. 20 *d*

♂ unknown.

♀ (in fluid). Head yellowish-brown, chestnut-brown between ocelli, occiput mottled with darker yellowish-brown. Antennae dark brown, about as long as fore wing. Pronotum transverse, slightly narrowed anteriorly, anterior margin convex; transverse furrows broad and distinct, a short median impressed line; disk on either side with obscure brownish markings, surface finely rugulose. Legs dull brownish, darker on knees and tarsi: each femur below with two narrow black streaks, posterior streak obsolete at base. Meso- and metacoxae on upper surface at base with a distinct black streak. Mesosternum on each side with a dark brown streak.

Wings brownish, with brown venation; apices slightly more acute than in *uniformis*; in three out of four examples, Cu1 in fore wing forks some way beyond the fork of M and termination of Cu2. (Lines drawn from these points to the fork of Cu1 form approximately a right angle; in *uniformis* this angle is decidedly obtuse.) In hind wing Rs and M separate some distance from base.

Abdomen whitish, except eighth sternite and parts of ninth and tenth segments, which are brownish. Eighth sternite more or less produced at its centre in a sub-genital plate, pigmented as in Fig. 20 *d*. Sub-anal plates broad, apices triangular and divergent. Cerci short, nine- or ten-segmented.

Length of fore wing 10 mm., of hind wing 9 mm.

AUSTRALIA: New South Wales, Mt. Kosciusko, 10–15.xii.1934, 4 ♀ (R. J. Tillyard).

Type female in form of a microscope preparation, paratypes in 2 per cent. formaldehyde solution.

This species may possibly be the female of *D. uniformis*, but as there are a number of minor differences, it has been considered preferable to regard it as distinct. The chief differences are in the shape of the pronotum, which is less narrowed anteriorly, the black streaks on the femora and the black markings on the meso- and metacoxae.

### *Dinotoperla fasciata* Tillyard

FIG. 22

*Dinotoperla fasciata* Tillyard, 1924, *Trans. Roy. Soc. S. Aust.* **48:** 193; 1926, *Ins. Aust. & N.Z.*: 119, pl. 10, fig. 13.

The female holotype has been severely damaged by *Anthrenus*, and little but the wings remain. Tillyard describes it as follows:

'♀. Length of body 6 mm., of forewing 10 mm., antenna 7 mm., cerci 1 mm. Head black, antennae dark brown; pronotum pale yellowish; rest of thorax black, abdomen dark brown. Forewings suffused with pale fuscous, venation darker fuscous; distal cross-veins surrounded by darker fuscous areas and so arranged that from three to four irregular transverse fasciae cross that part of the wing. Hindwings darker fuscous with a few darkened cross-veins placed distally between C, R1, and Rs.'

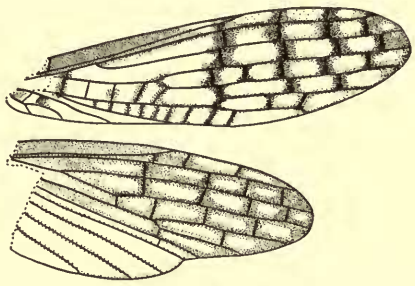

FIG. 22. *Dinotoperla fasciata* Tillyard. ♀ Type. Wings.

To this may be added that there are two or three cross-veins in the pterostigmatic area in both wings, and that there are distal cross-veins in the hind wing other than those specially mentioned by Tillyard.

Holotype female (National Park, S. Queensland, 1,500–2,000 ft., Dr. A. J. Turner), in the British Museum (Nat. Hist.), from the Tillyard collection. Paratype female, slightly smaller in size and with less distinct fasciae (same locality, March, 1921, G. H. Hardy) in Queensland Museum, Brisbane.

### *Dinotoperla* sp. nymph

FIGS. 23–24

General colour yellow-brown, with scanty darker markings; of medium build, not very slender, about 7 mm. long; sparsely clothed with small hairs, expanded at their bases, apices slender, generally curved or hooked.

Head a little wider than pronotum, widest at compound eyes, rounded behind; stem of epicranial suture about two-sevenths as long as pronotum. Antennae moderately long, extending beyond the apex of the posterior wing pads; first segment large, flattened dorso-ventrally, slightly tapering, second segment short, third about as long as second, remainder short, tapering to apex; each segment almost bare, with only a few short bristles at apex.

Labrum short, broad, anterior angles rounded. Labium with the glossae and paraglossae of about equal length, apices ciliate. Incision between glossae deeper than that cutting off paraglossae, both very narrow; paraglossae rather broader than glossae, outer margins strongly convex. Labial palpus three-segmented, segments increasing in length from base to apex in ratio 1 : 1·5 : 2; second segment dilated towards its apex, third ovate. Maxillae well developed: lacinia with two acute teeth at its apex, beneath which, on inner surface, is a short row of stiff setae; galea scarcely extending beyond lacinia, curved, tapering towards its apex, which is obliquely

truncate and set with minute setae; palpifer indistinct, membranous; palpus five-segmented, one and two short, subequal, three as long as one and two combined, four

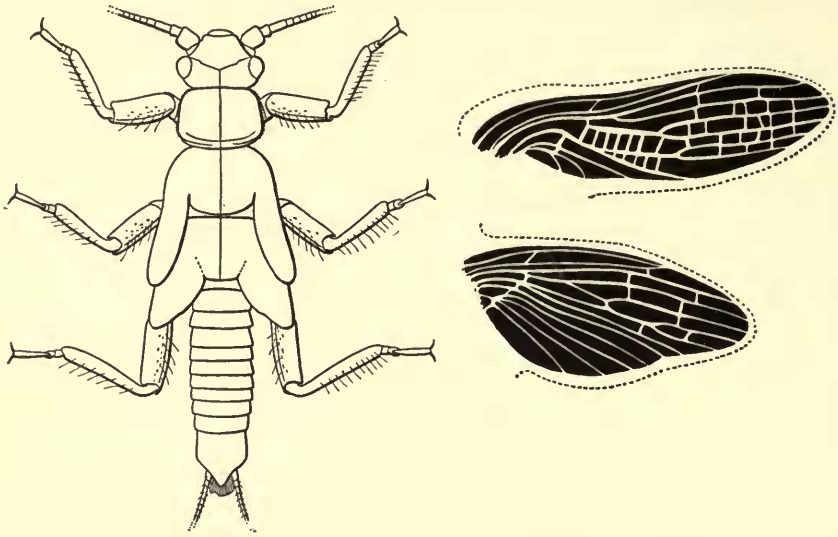

FIG. 23. *Dinotoperla* sp. Nymph and nymphal venation.

rather longer than two, and five as long as three and four together. Mandibles heavily chitinized, with a number of strong teeth near the apex, beneath which is a well-developed mola with a row of short setae.

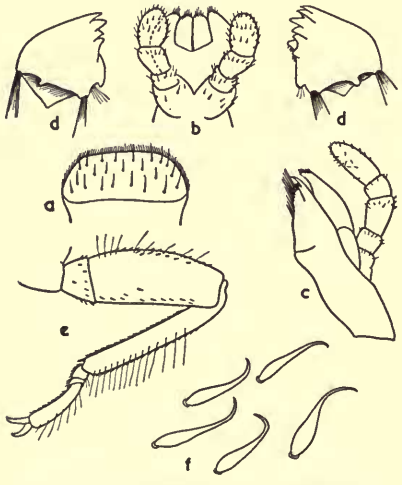


FIG. 24. *Dinotoperla* sp. Nymphal structures. *a*, labrum; *b*, labium; *c*, maxilla; *d*, mandibles; *e*, leg; *f*, vestiture.

Pronotum with a number of straggling brownish marks on disk, median suture pale; broader than long, slightly narrowed anteriorly, angles rounded. Wing pads extending backwards and almost horizontal. Fore wing pads elongate, overlapping more than half of the posterior pads; latter somewhat broader, anal fan not very pronounced. Main venation visible as lines of pigmentation bearing short hairs. If viewed by transmitted light, the veins and cross-veins appear as clearer spaces in the tissue of the wing. Under these conditions, the cross-vein designated M5 by Tillyard is very evident and is generally thicker than the succeeding medio-cubital veins.

Legs short and strong, prothoracic the shortest, increasing in length to the metathoracic, sparsely clothed with short dilated hairs, outer surface of tibiae with a scanty row of longer, very fine setae. Femora shorter and broader than tibiae, anterior surfaces with a brownish line, not reaching the apex. Tibia with a slender band

below the knee and a narrow longitudinal streak on anterior surface. Tarsi three-segmented, second very short, third about four times as long as first, and provided with a pair of simple claws at apex.

Abdomen cylindrical, segments one to nine with straight apical margins, and dorsally with a double row of spots, fairly close together. Tenth tergite as long as five preceding tergites, apical margin produced and somewhat elevated in male, rounded in female. Sub-anal plates elongate, triangular. Projecting beyond them is a dense tuft or rosette of mauve anal gill-filaments. Cerci short, tapering to apex, about twenty segments, basal segments shorter than broad, apical segments longer than broad, segments with a few short apical setae, no dorsal fringe.

AUSTRALIA: F.C.T., Cottar River, 14.ix.1933 (W. L. Raitt); other examples, rather darker, from New South Wales, Rule's Point, 4,450 ft., 30.xii.1934, and TASMANIA, R. Ouse, 4.ii.1933 (R. J. Tillyard).

## *TRINOTOPERLA* Tillyard

*Trinotoperla* Tillyard, 1924, *Trans. Roy. Soc. S. Aust.* **48:** 193.
Type species: *T. irrorata* Tillyard, 1924 (fixed by Tillyard, 1924).

Fore wings with Rs forked, sometimes three-branched, M forked near middle of wing. Cu1 two- or three-branched (sometimes in males the lowest branch is very short and forms a closed cell with the one above it); cubito-anal space with only a basal cross-vein; a thickened cross-vein between 1A and 2A. Hind wing with Rs forked, M forked, posterior branch soon fusing with Cu1, and separating again, generally some distance from the wing margin; apex narrowly rounded; anal fan moderately or rather narrow, generally without any cross-veins. Cerci short. Size of species medium to large, expanse from about 25 mm. to over 50 mm.

*Distribution*: Australia; ? Tasmania, known from nymphs only.

### *Trinotoperla irrorata* Tillyard

FIG. 25

*Trinotoperla irrorata* Tillyard, 1924, *Trans. Roy. Soc. S. Aust.* **48:** 194, fig. 1; 1926, *Ins. Aust. & N.Z.*: 119, pl. 10, fig. 14.

The type and allotype have suffered severely from the depredations of *Anthrenus*, little remaining apart from the wings. I am therefore quoting the original description and adding extra notes where possible.

'♀ Holotype: Length of body 20 mm., of forewing 25 mm., antennae 17 mm., cerci barely 3 mm. Body dark fuscous, marked with dull brown; antennae dull brownish with slight fuscous annulations; legs dull brownish varied with dark fuscous. Wings pale greyish with dark fuscous veins, those of the basal half of the hind wing inclining to brownish' (the whole of the fore wing and to a lesser degree, the distal part of the hind wing, speckled with dark brown spots, and most of the cross-veins margined with darker brown. Posterior margin of fore wing with a small distinct angular lobe between Cu1 and Cu2, rather more pronounced than in Tillyard's figure). 'Forewing with a complete series of costal veinlets; hindwings with *hm* and three or four distal costal veinlets only.' (Costal margin of hind wing very

slightly scalloped.) 'Thickened cross-vein between 1A and 2A in forewing blackish, very prominent.'

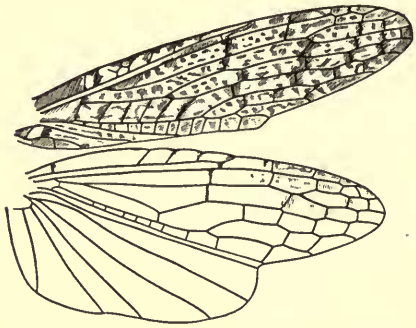

FIG. 25. *Trinotoperla irrorata* Tillyard. ♀ Type. Wings.

'♂ Allotype. Smaller and slightly paler and less strongly irrorated than female. Length of body 17 mm., forewing 21 mm. Supra-anal plate with a slender copulatory process directed upwards and ending in a small hook directed posteriad; paraprocts upcurved, forming two flatly rounded lobes directed forward and upward. Tenth tergite with a raised flap distally.'

AUSTRALIA: New South Wales, Mt. Kosciusko, 5,000–5,500 ft., 24.xi.1921 (R. J. Tillyard). Holotype female, allotype male in British Museum (Nat. Hist.), from the Tillyard collection.

## *Trinotoperla australis* Tillyard

FIGS. 26–28

*Trinotoperla australis* Tillyard, 1924, *Trans. Roy. Soc. S. Aust.* **48**: 194; 1926, *Ins. Aust. & N.Z.*: 119, pl. 10, fig. 15.

Female holotype: Head, thorax, and abdomen fuscous; antennae fuscous, three-quarters as long as fore wing. Pronotum a little broader than long, quadrate, anterior

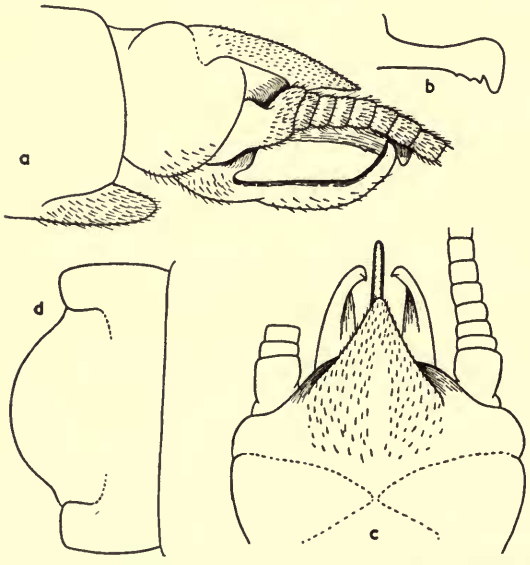


FIG. 26. *Trinotoperla australis* Tillyard. ♂ genitalia. *a*, lateral, *b*, apex of supra-anal lobe, lateral, *c*, dorsal, *d*, subgenital plate, ventral.

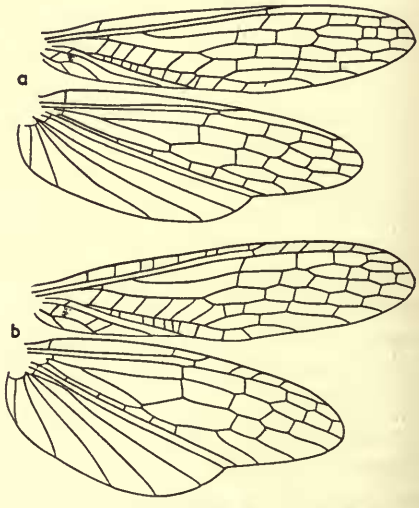


FIG. 27. *Trinotoperla* spp. ♀ Wings. *a*, *T. australis* Tillyard; *b*, *T. nivata* sp.n.

and posterior margins slightly rounded, a median impressed line, not reaching anterior margin, and posteriorly ending in a transverse groove. Legs fuscous. Wings pale brownish-fuscous, venation darker, cross-veins narrowly bordered. Very few costal cross-veins, no pronounced angular lobe on posterior margin of fore wing. Costal margin of hind wing evenly arched. Thickened cross-vein between 1A and 2A in fore wing brownish, less conspicuous than in *irrorata*.

Subgenital plate of the female holotype is creased and probably distorted. The apical margin is slightly produced and rounded, and appears to have a small rounded excision at its centre. I strongly suspect that this excision is accidental, as I have examined a number of examples from South Australia, agreeing in other respects, in which the subgenital plate is evenly rounded and not excised. I am figuring the subgenital plate of one of these for comparison. In most of these there is a strongly pigmented bar near each lateral margin. Sub-anal plates broad at their bases, with rather broad rounded apices, which are divergent. Cerci filiform, brownish, incomplete in the type, in other examples about fifteen-segmented. Apical margin of tenth tergite deflexed, rounded, with a slight projection at its centre.

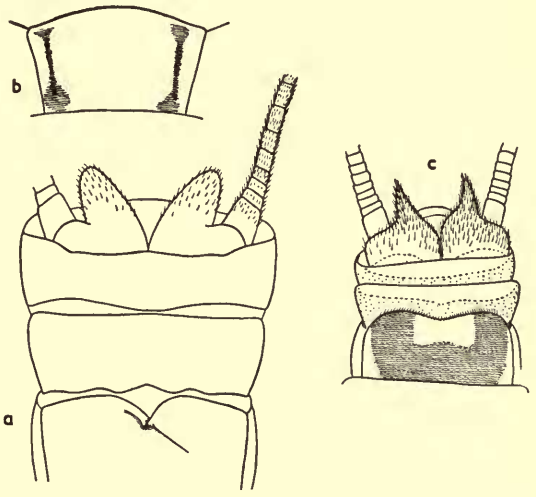


FIG. 28. *Trinotoperla* spp. ♀. *a–b*, *T. australis* Tillyard; *c*, *T. nivata* sp.n. *a*, genitalia ventral of holotype; *b*, subgenital plate of another example; *c*, genitalia ventral.

Male. Tenth tergite produced in a pale triangular process, rather flattened and acute from the side. Supra-anal lobe long, slender from above; from the side rather deep and somewhat dilated at its apex. Just before the apex on the ventral surface is a small acute excision, giving the apex the appearance of a blunt hook. Basad of this excision are a few minute teeth. Sub-anal plates long, slender, and a little upcurved from the side, apices incurving and acute. From beneath they are broad at their bases, inner lower surfaces membranous. Cerci short, brownish, curving downwards, basal segment rather constricted from the side, about seventeen segments. Subgenital plate broad, apical margin rounded, and moderately produced. The basal margins are more heavily pigmented than the remainder of the tergite.

Length of fore wing, ♂ 18 mm., ♀ 18–20 mm.

Length of hind wing, ♂ 16 mm., ♀ 17–18 mm.

AUSTRALIA: The locality of the holotype is New South Wales, Towac, near Mount Canoblas, 7.x.1916 (R. J. Tillyard). I have seen other specimens from Mt. Kosciusko, Spencer's Creek, xii.1932, and Bolaro, 22.xii.1935, and from the Murrumbidgee River, F.C.T., i.1922, all collected by R. J. Tillyard, and other pinned examples from the McLachlan Collection, labelled Melbourne, S. Australia, or merely Australia.

This species bears a superficial resemblance to the new species *nivata* and *minor*, but

may be distinguished by the male genitalia, and by the rounded sub-anal plates of the female. The wings are rather narrower.

### *Trinotoperla nivata* sp.n.

FIGS. 27, 28

♂ unknown.

♀ (in fluid). Head reddish-brown, with a small area on the clypeus, and the post-ocellar sutures pale. Antennal brown, long (incomplete in the type). Thorax fuscous, pronotum a little broader than long, slightly narrowed anteriorly, angles not produced; a short, median, impressed line, all margins somewhat elevated. Legs medium fuscous, knees darker, a pale spot in centre of anterior surface of each femur. Lower anterior apical angle of each femur produced in a small tooth. Abdomen whitish, except tenth tergite, eighth to tenth sternites, sub-anal plates and cerci, which are brownish. Wings greyish-brown, not irrorated, anterior darker than posterior; veins darker, faintly shaded. A number of costal cross-veins in fore wing; posterior margin of this wing scarcely produced in a lobe about the end of Cu1. Angle between anal fan and posterior margin of hind wing clearly greater than a right angle.

Subgenital plate about twice as broad as long, apical margin not very produced, broadly excised at its centre; brown, with a quadrate area at the centre of the apical margin, and the lateral margins pale. Sub-anal plates broad at bases, apices produced in acute fingers, curving upward and slightly inward. Cerci short, about 1·7 mm., sixteen or seventeen segments, basal segments much broader than long.

Length of fore wing, 16 mm., of hind wing, 15 mm.

AUSTRALIA: Victoria, Snowy River, 3.i.1933, 1 ♀ (R. J. Tillyard).

Type is a microscope preparation.

*T. irrorata* Tillyard, which this species somewhat resembles, may be separated by its larger size, distinctly mottled fore wing, a small but distinct rounded lobe on the posterior margin of fore wing, and by the angle between the anal fan and the posterior margin of the hind wing being only a little greater than a right angle. The female holotype of *irrorata* suffered greatly from the ravages of *Anthrenus* whilst in Tillyard's possession, and little now remains of the body. The sub-anal plate appears to be of the pattern of *nivata*, but the apex is less acute.

### *Trinotoperla minor* sp.n.

FIG. 29

(In fluid.) General appearance much as in *T. nivata*. Legs with the pale area of the femur less pronounced, upper surface darker, lower apical angle toothed. Abdomen whitish, except eighth to tenth segments in male, and tenth tergite, eighth to tenth sternites in female, which are brownish. Wings rather more elongate than in *nivata*, a little paler, and without costal cross-veins, apart from the humeral. In the hind wing there may be a cross-vein between 1A and 2A near their apices. The angle formed by the posterior margin and the anal fan is more obtuse.

♂. Tenth tergite from above produced in a rather narrow, membranous lobe or flap, rather flattened from the side. Supra-anal lobe slender, somewhat dilated before

its apex, which curves downward in an acute spine. Cerci pale brownish, curving gently downward, seventeen-segmented, segments at the base very short and broad, gradually increasing in length and becoming narrower towards the apex. Sub-anal plates rather broad, especially from beneath, curving upward on either side of the supra-anal lobe, and with rounded apices. Subgenital plate strongly produced, triangular, with a truncate apex.

♀. Very like *T. nivata*. Subgenital plate without a pale quadrate area at the centre of the apical margin. In *nivata* this pale area seems to be more closely set with fine

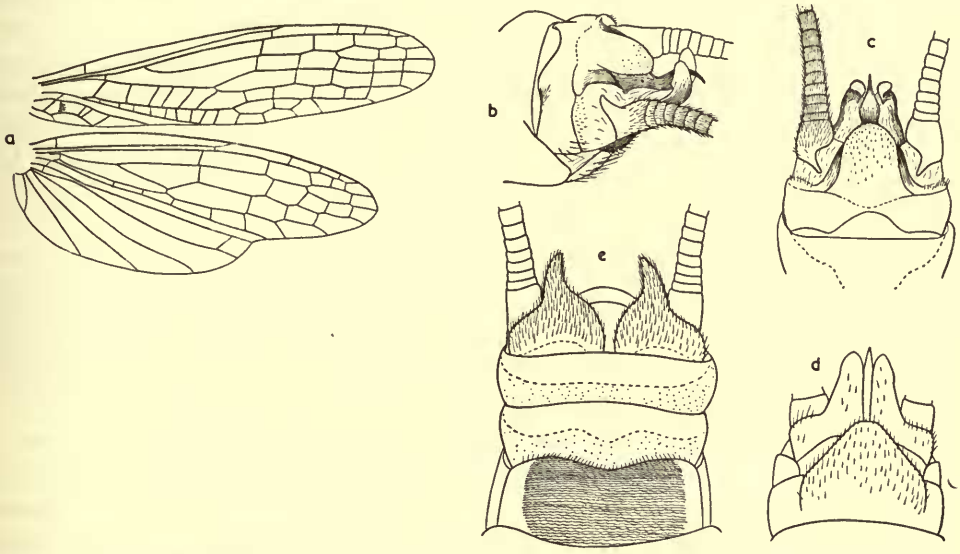


FIG. 29. *Trinotoperla minor* sp.n. *a*, wings ♂; *b–d*, genitalia ♂, *b*, dorso-lateral, *c*, dorsal, *d*, ventral; *e*, genitalia ♀, ventral.

hairs than its surroundings, but in *minor* the clothing is uniform. Apices of the sub-anal plates a little more incurved, and slightly longer in comparison with their bases. Cerci similar, seventeen-segmented, about 1·6 mm. long.

Length of fore wing, ♂ 11 mm., ♀ 12 mm.

Length of hind wing, ♂ 10 mm., ♀ 11 mm.

AUSTRALIA: New South Wales, Bolaro, xii.1935, 2 ♂, 3 ♀ (R. J. Tillyard).

Type male, paratype female as microscope preparations, remainder in 2 per cent. formaldehyde solution.

### ***Trinotoperla minor*** nymph

FIGS. 30–32

(Mature nymph, about to emerge.) General colour brownish, pronotum and legs paler; medium build, legs longer than in *Dinotoperla*, length of nymph about 9 mm. A conspicuous fringe or crest of fine setae along the median dorsal line of body, and along legs, cerci, and basal segments of antennae. Body clothed with a sparse mixture of fine hairs and short stout ovate setae. Head dark brown, broader than pronotum,

widest at compound eyes, slightly rounded behind; stem of epicranial suture about one-third as long as pronotum. Antennae about as long as body, filiform, tapering; first segment large, with a dorsal crest of fine setae, second smaller, but longer than any of the next few succeeding segments, which become progressively longer and narrower from base to apex.

Labrum short and broad, anterior angles rounded. Labium with glossae slightly shorter than paraglossae, but of about equal width, apices with a dense tuft of fine setae. A narrow incision separating the glossae to their bases, and a wider one dividing them from the paraglossae, whose outer margins are convex. Palpus three-segmented, segments of roughly equal width, increasing in length from base to apex in ratio 1 : 1·5 : 2. Maxillae well developed, lacinia with a pair of broad truncate teeth at its apex, beneath which on its inner surface is a row of stout setae. Maxillary palpus five-segmented, arising from a membranous palpifer; first and second segments subequal, third somewhat shorter than the first and second together, fourth a shade longer than the second, and the fifth as long as the third.

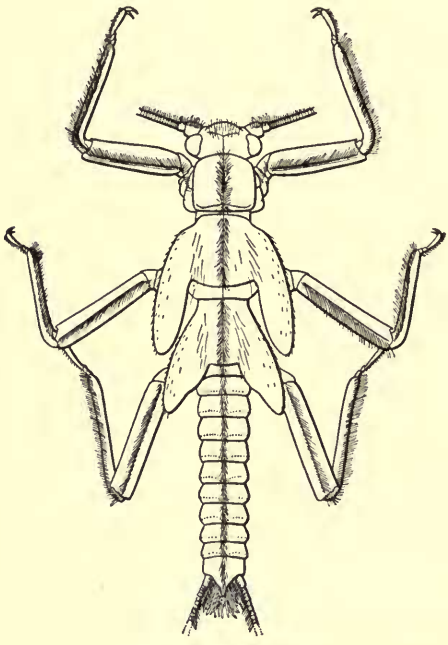

FIG. 30. *Trinotoperla minor* sp.n. Nymph.

Pronotum pale yellowish-brown, with a short, impressed, dark brown median line, and on either side of it a curved brownish band, its convex surface inwards, and a smaller streak near the posterior angles. Pronotum quadrate, slightly broader than long, angles rounded; posterior transverse furrow more noticeable than anterior. Wing pads extending backwards, almost horizontal. Fore wing pad elongate, covering about half of posterior pad; the latter is broader, the anal fan extending a full half of the posterior margin. Enclosed wings folded ready for emergence, venation appearing as pale lines on brownish ground of wing cover. (The venation figure has been drawn from a younger nymph, in which the pads are naturally smaller and relatively broader.)

Legs moderately short, prothoracic the shortest, each with a dense crest of fine long setae situated on the dorsum of each coxa, trochanter and tarsus, anterior dorsal margin of femur and anterior surface of tibia. Femur shorter than tibia, with a broad, light brown band before the knee, and a faint stripe of the same colour near the fringe, lower apical angle slightly produced. Tibia with a brownish band at the knee and the outer surface narrowly brown. Tarsus brownish, second segment shorter than the first, third about three times as long as first and second together, claws simple.

Abdomen cylindrical, brownish, segments one to nine with whitish apical margins, tenth tergite rather longer than eighth and ninth together, the centre of its apical

margin produced in a rounded lobe, which is itself further produced in a slender finger. A dense tuft of whitish anal gill-filaments. Sub-anal plates brown, roughly triangular, apices divergent, rounded, whitish, outer margins broadly excised. Cerci long, with more than forty segments, slender, with a dense dorsal crest of fine, long setae; each segment ventrally at its apex with a few short setae.

AUSTRALIA: New South Wales, Bolaro, 22.xii.1935 (R. J. Tillyard).

The material furnishing this description was collected at the same time and place as the adults of *T. minor*. It consists chiefly of fully matured nymphs, so mature that the wings within the pads are folded ready for emergence. There are also from the same locality two or three smaller nymphs, probably about half-grown, in which the imaginal venation can be discerned, and this venation closely resembles that of *T. minor* adults. I think there can be little doubt that these are the nymphs of *T. minor*.

### *Trinotoperla* sp. No. 1

FIGS. 31–32

Last instar nymph: Related to *T. minor* but differing in details, notably venation of hind wing, form of mouth-parts and vestiture. General colour light brownish, with darker markings, length about 13 mm. Median dorsal fringe less prominent; body sparsely clothed with a mixture of short curved setae and short dilated hairs. The

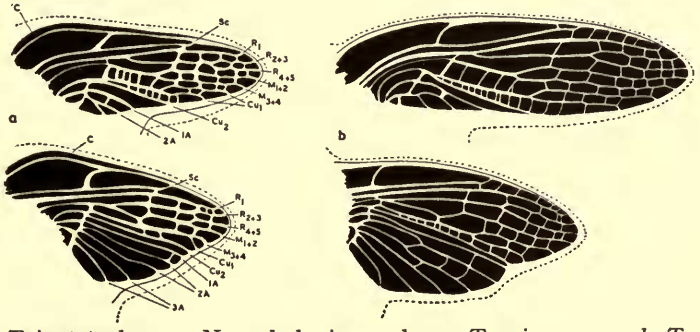


FIG. 31. *Trinotoperla* spp. Nymphal wing pads. *a*, *T. minor* sp.n.; *b*, *T.* sp. No. 1.

latter are somewhat excised at their apices and trough-shaped in cross-section; those of *T. minor* are relatively larger and cylindrical in section. Head dark brown, paler at centre of vertex, broader than pronotum, stem of epicranial suture between one-third and one-quarter as long as pronotum. Antennae longer than body (about 16 mm.), filiform, tapering, first segment large, with a crest of fine setae, second smaller, but broader and longer than any of the next few succeeding segments, which also carry a dorsal fringe. Terminal segments longer than broad.

Labrum short and broad, narrowing to a broadly and shallowly excised apex. Labium with the glossae about the same length but somewhat narrower than the paraglossae, apices more pointed than in *T. minor*, and armed with a tuft of setae. Outer margin of paraglossae slightly sinuous, so that the apex is more acute than in *T. minor*. Palpus three-segmented, first about half as long as second, which is a little

shorter than third. Maxillae well developed, lacina terminating in a single truncate tooth, and a number of stout setae; galea much as in *T. minor*. Maxillary palpus five-segmented, extending about as far as apex of lacinia; first and second subequal, third twice as long, fourth a little longer than second, fifth about as long as third. Mandibles with a few rather blunt teeth.

Pronotum similar to *T. minor*, but more heavily marked. Lower anterior apical angle of femur not produced. Tibia with an additional narrow brown band on inner anterior surface, parallel to fringe. Abdomen cylindrical, brownish above, tergites

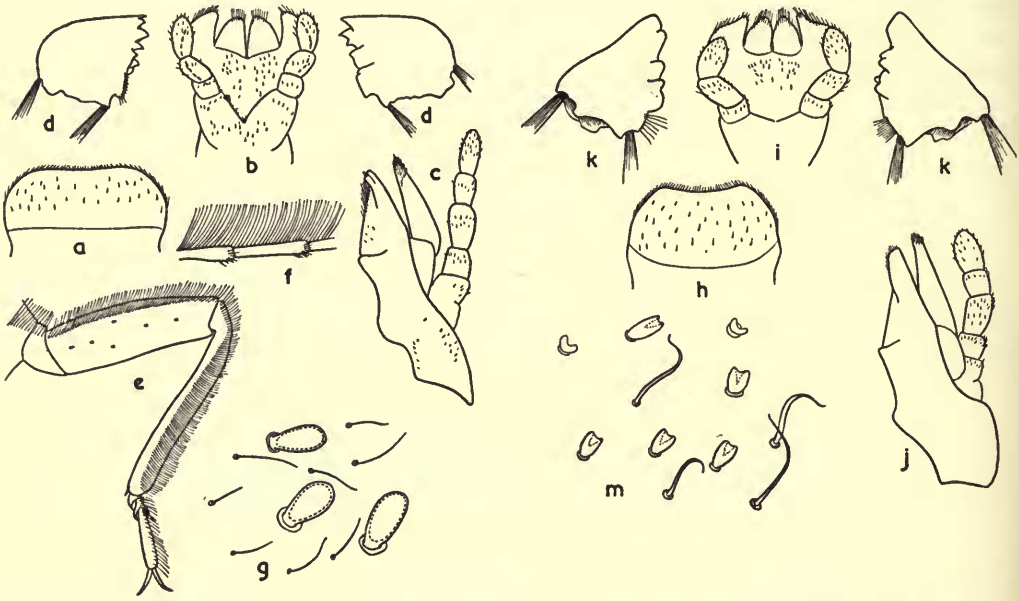


FIG. 32. *Trinotoperla* spp. Nymphal structure. *a–g*, *T. minor*; *h–m*, *T.* sp. No. 1. *a*, labrum; *b*, labium; *c*, maxilla; *d*, mandibles; *e*, leg; *f*, portion of cercus; *g*, vestiture; *h*, labrum; *i*, labium; *j*, maxilla; *k*, mandibles; *m*, vestiture.

one to nine with a whitish apical margin; sternites light yellowish-brown, with golden pubescence. Tenth tergite longer than eight and nine together, centre of its apical margin produced, obtuse, not produced in a finger as in *T. minor*. Anal gills whitish. Sub-anal plates much as in *minor*. Cerci long (10 mm)., slender, about sixty segments, carrying a dorsal fringe as in *minor*.

TASMANIA: Scottsdale, Cuckoo Falls Creek, 31.vii.1931 (R. J. Tillyard).

Four male nymphs, two apparently last instar, and two with very rudimentary wing pads. Up to the time of writing I have not seen any adult *Trinotoperla* from Tasmania, but from wing-venation these nymphs undoubtedly belong to that genus. The presence of cross-veins in the anal fan suggests *Eunotoperla*, but the venation of the fore wing is different. The practice of describing new species of Plecoptera from the nymphs alone is undesirable, and in consequence I am giving these nymphs numbers instead of names. I have also seen single examples of two more species of *Trinotoperla* from the same locality, but as material is so scanty I propose to do nothing further with them at present.

## *Trinotoperla* sp. No. 2

FIGS. 33, 34

Mature nymph: General colour light yellowish-brown, male about 9 mm., female about 12 mm. long; medium to rather stout build, legs long and sprawling; clothed throughout with short curved setae, which arise from globular tubercles: setae widened at their bases, apices very slender. Head flattened, only slightly wider than

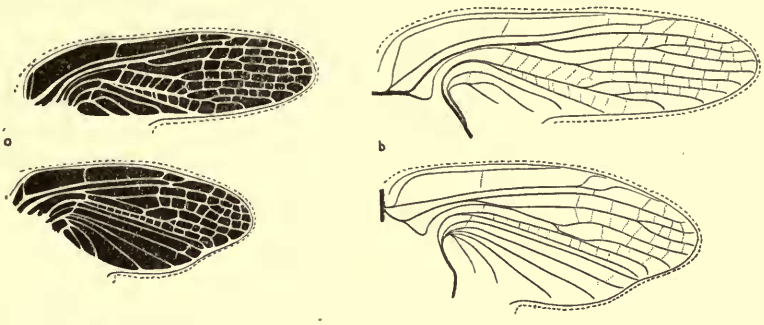


FIG. 33. *Trinotoperla* sp. No. 2. *a*, nymphal wing pads; *b*, tracheal venation.

pronotum; antennae about as long, or a little longer than body, filiform, tapering, a small dorsal fringe at base.

Labrum bent downwards, concealed under the head, apex directed caudad; short and broad, apical margin slightly emarginate, angles rounded. Labium with the glossae slightly shorter and narrower than the paraglossae. Palpus short and stout, not reaching apex of paraglossae, apical segment about twice as long as basal, second rather shorter than third. Maxilla strong, lacinia with about three acute teeth at its apex, and a number of bristles. Galea tapering, rather hairy. Maxillary palpus rather short and stout, first segment half as long as second, which is two-thirds as long as third. Fourth as long as second, fifth as long as third. Mandibles strong, with numerous acute teeth.

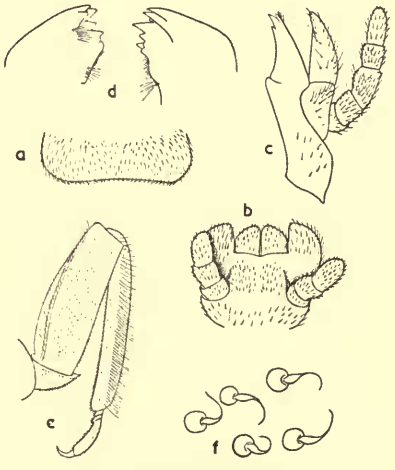


FIG. 34. *Trinotoperla* sp. No. 2. Nymphal structures. *a*, labrum; *b*, labium; *c*, maxilla; *d*, mandibles; *e*, leg; *f*, vestiture.

Pronotum quadrate, side margins parallel or slightly convergent anteriorly, anterior and posterior margins gently rounded, angles pronounced; a slight median line and a strong transverse posterior furrow. Wing pads large, anterior elongate, posterior broader, yellowish-brown, venation indicated by rows of brownish setae, arising from globular bases. In the only large male nymph the tracheal venation is quite evident as well as the imaginal venation, and in the hind wing the fusions of Rs and M, and M3+4 and Cu1 are clearly shown, confirming Tillyard's study of

*Dinotoperla*. Cross-veins in the apical half of the wing dense, including several in the pterostigmatic area.

Legs rather long and sprawling, in the male giving a somewhat Ecdyonurid appearance. Trochanters, particularly of anterior legs, with an acute spur at lower apical angle. Femora strongly carinate dorsally, all legs with a dense dorsal fringe.

Abdomen cylindrical, in male shorter than hind femur, in female longer. In male, segments one to nine very short, tenth tergite as long as tergites three to nine, apical margin produced in an acute, somewhat raised point. Basal margins of tergites nine and ten each with a pair of stout finger-like apodemes. Cerci long, tapering, with at least thirty-six segments, bearing a dorsal fringe. Sub-anal plates moderately long, broad at base, tapering near apex, which is rounded. Anal gills pale mauve. In female, segments one to nine longer than in male, tenth tergite about as long as tergites seven to nine, apical margin evenly rounded. Apodemes of tergites nine and ten more noticeable. Cerci similar to male, sub-anal plates rather shorter and blunter.

AUSTRALIA: New South Wales, Bolaro, 22.xii.1935, 3 ♀; Rule's Point, 4,450 ft., 30.xii.1934, 1 ♂, 2 ♀ (R. J. Tillyard).

The rather sprawling appearance of the nymph, the backwardly deflected labrum, and the acute spine on the anterior trochanter separate this species from any other *Trinotoperla* nymph which I have seen.

## Fam. NEMOURIDAE Klapálek 1909

This family, which occurs so abundantly in the Northern Hemisphere, is represented in the Southern by about eight genera, comprising at present comparatively few species. They differ to some extent from the typical Northern Nemouridae, particularly in the venation, the fore wing resembling more that of the family Leuctridae. They are nevertheless true Nemouridae, as in the hind wing the media is clearly forked and there are five veins on the anal fan. In the Leuctridae the media is apparently simple, Cu1 being apparently forked, and there are only three veins on the anal fan. It is probable that in the latter family the cross-vein from the media to the cubitus is the branch M3+4, which then fuses with Cu1 and subsequently diverges again to form the apparent fork of Cu1. In the hind wing, Rs and M are united at base, whereas in Leuctridae M arises from a cross-vein uniting Rs and Cu.

In view of the differences in venation, it seems desirable to place the Nemouridae of the Southern Hemisphere in a separate subfamily, characterized as follows:

### NOTONEMOURINAE Ricker 1950[1]

Fore wing with Cu2 long, generally extending well into the apical half of the wing; cross-vein in the pterostigmatic area of both wings either absent or present. Hind wing with the media forking at or before the radio-medial cross-vein.

The subfamily will include the following genera:

| | |
|---|---|
| *Aphanicerca* Tillyard | S. Africa. |
| *Aphanicercella* Tillyard | ,, |
| *Aphanicercopsis* Barnard | ,, |

[1] See Appendix, p. 92.

| | |
|---|---|
| *Desmonemoura* Tillyard | S. Africa |
| *Neonemura* Navás | Chile. |
| *Notonemoura* Tillyard | New Zealand. |
| *Spaniocerca* Tillyard | ,, ,, Australia, Tasmania. |
| *Spaniocercoides* Kimmins | ,, ,, |
| *Udamocercia* Enderlein | S. America, Tasmania. |

*Neonemura* Navás is probably a synonym of *Udamocercia* Enderlein. It is described from a female, which possesses an ovipositor similar to that of *Udamocercia*. *Nemura pirioni* Navás, from Chile, should also be transferred to the Notonemourinae on the evidence of the long Cu2 figured in the fore wing; it is probably a *Udamocercia*.

The venation of the Nemouridae as a whole offers few characters of value for generic separation. It is comparatively simple, though not primitive in type, and tends to be variable in the position and number of the cross-veins. The males of the three species of *Spaniocerca* from Australia and Tasmania which I have examined, whilst obviously related to each other, differ somewhat in genitalic pattern from the New Zealand species; had the females shown similar affinities, it might have been desirable to separate generically the Australian and Tasmanian species from those occurring in New Zealand. Unfortunately the females differ in genitalic pattern not only from each other but also from *S. zelandica* Tillyard. Pending the acquisition of further material from these regions, it seems preferable to retain the Australian and Tasmanian forms in *Spaniocerca* and to extend its generic diagnosis to accommodate them, rather than to make a new genus based on male genitalic characters only.

The two remaining Nemourid species with which I am dealing in this paper are placed for convenience into the genus *Udamocercia* Enderlein. The male genitalia of one of the species (*U. albomacula*) are almost identical in pattern with those of two South American species of this genus. The other species shows a striking development of the supra-anal lobe, and the cerci are modified, but the general pattern is similar. Both species possess a cross-vein in the pterostigma of both wings (contrary to Enderlein's diagnosis), but this is probably variable as in both the South American species which I have examined it is present, although sometimes obscure. In view of the scanty material available—two males of different species, and a female which possibly belongs here—it seems unwise to erect a new genus for these Tasmanian species now.

## *SPANIOCERCA* Tillyard

*Spaniocerca* Tillyard, 1923, *Trans. N.Z. Inst.* **54:** 216, fig.; Kimmins, 1938, *Ann. Mag. Nat. Hist.* (11) **2:** 572.

Type species: *Spaniocerca zelandica* Tillyard, 1923 (Monotypic genus).

*Revised generic diagnosis*

Sc arching up so as to meet or almost meet costa; cross-vein M—Cu in fore wing ending above on M3+4 at an angle to it; the latter vein generally curved as it leaves the transverse cord. Pterostigma in both wings without, or with only one cross-vein. Anal fan moderately narrow, somewhat excised at apex of fourth anal vein.

♂. Ninth tergite with apical margin generally produced in a pair of spines or lobes.

Ninth sternite more or less produced apically as a subgenital plate, with a median ventral lobe. Titillators of varying length, two-branched (New Zealand) or unbranched (Australia, Tasmania), arising near the apex of the ninth sternite. Cerci simple, sometimes angled. Supra-anal lobe in form of upturned hook.

♀. Margin of eighth sternite simple, or produced in a subgenital plate. Ninth sternite sometimes produced.

### *Spaniocerca tasmanica* Tillyard

FIGS. 35–36

*Spaniocerca tasmanica* Tillyard, 1924, *Trans. Roy. Soc. S. Aust.* **48:** 195, fig. 3.

The holotype female has been reduced to two anterior and one posterior wings by the action of *Anthrenus*. The following descriptions have been made from a male and a female in fluid.

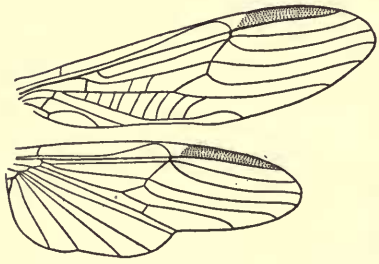

FIG. 35. *Spaniocerca tasmanica* Tillyard. Wings.

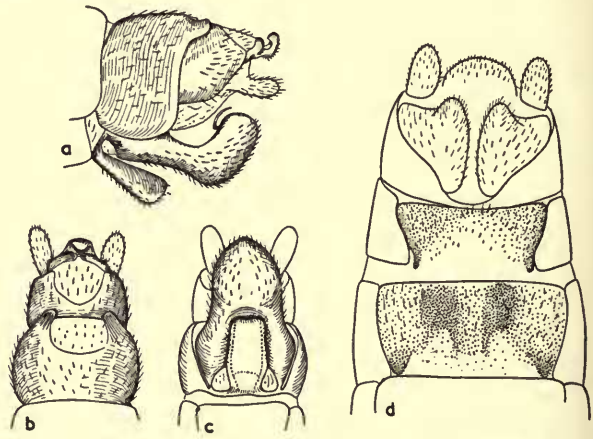


FIG. 36. *Spaniocerca tasmanica* Tillyard. Genitalia ♂, *a*, lateral; *b*, dorsal; *c*, ventral; *d*, genitalia ♀, ventral.

♂. Head dark brown, occiput orange-brown; antennae piceous, finely annulated with yellowish at sutures. Pronotum dark brown, quadrate, a little broader than long, anterior transverse furrow deep. Meso- and metanota shining piceous. Legs yellowish-brown to dark brown, femora with a conspicuous median ring of yellowish. Wings shining smoky-brownish, pterostigma darker, a few inconspicuous paler areas, especially distad of transverse cord and along cubitus of anterior wing. Venation brown; generally no cross-vein in pterostigma of either wing, or if present, indistinct; generally two medio-cubital cross-veins between M5 and the transverse cord.

Abdomen whitish except segments nine and ten, which are brown. Ninth tergite produced on either side of centre in a flattened rounded lobe; between the lobes is a transparent membranous area. Tenth tergite also with a membranous area at centre of apical margin, supra-anal lobe in form of a short broad hook, upcurved from a broad base. Cerci short, stout, lightly pigmented, clothed with short hairs. Ninth sternite with a strong ventral lobe, from the side dilating triangularly to a truncate apex; from beneath quadrate, slightly constricted at its base, apex faintly excised.

From the side, the sternite is produced, its apex bent sharply upward and dilated. From beneath it is slightly narrowed about midway, with an elliptical apex. From the upper apical margin arises a pair of small, scythe-like hooks, probably reduced titillators.

♀. Similar, larger. Wings with more definite hyaline areas. Abdomen whitish, seventh sternite, eighth and ninth segments brownish. Neither seventh nor eighth sternites produced, margins straight, both with hyaline areas at base. Sub-anal plates triangular, apices rounded, upper margins shallowly excised. Cerci short and stout.

Length of fore wing, ♂ 7 mm., ♀ 9·4 mm.

Length of hind wing, ♂ 5·3 mm., ♀ 8 mm.

The holotype was taken at Mt. Wellington, TASMANIA, 31.i.1917 (R. J. Tillyard). Other Tasmanian examples in the British Museum from Sheffield, 8.i.1917 (R. J. Tillyard), Hobart, 15.x.1916 (C. E. Cole), 4.xi.1916 (G. H. Hardy), Penstock Lagoon, 29.i.1933, and Gouldt County, 10.ii.1933 (R. J. Tillyard). From the mainland of AUSTRALIA I have seen examples from New South Wales, Mt. Kosciusko, 24.xi.1921, 3–9.xii.1921; South Australia, Cudlee Creek, 20.xi.1934 (R. J. Tillyard), and Adelaide.

### *Spaniocerca tillyardi* sp.n.

FIG. 37

General appearance similar to *S. tasmanica*; there appear to be two forms of this species, one of which is smaller and paler than the other.

♂. Head dark brown, occiput a little paler; antennae piceous, with fine pale annulations at sutures. Pronotum dark brown, quadrate, a little broader than long, anterior margin somewhat convex, anterior transverse furrow deep. Meso- and metanota shining dark brown. Legs as in *tasmanica*. Wings rather narrower, shining smoky-brownish, with a hyaline area just beyond the transverse cord, and a larger one in the neighbourhood of Cu1. Venation dark brown, no cross-vein in pterostigma of either wing; one or two medio-cubital cross-veins between M5 and the transverse cord.

Abdominal segments pale or light brownish, apical margins whitish, segments eight to ten darker. Ninth tergite produced on either side in a flattened lobe, apices approaching one another calliper-wise. Between them the margin is excised and membranous. Tenth tergite also with a membranous area at the centre of its apical margin, giving the appearance of an excision. Supra-anal lobe broad and triangular at its base, a membranous area at its base separating two rounded hairy elevations. From the apex arises a slender hook, in side view with a rounded excision on dorsal surface near base. Cerci longer than in *tasmanica*, from the side angled upwards in the form of a foot. Ninth sternite long, more slender than in *tasmanica*, not dilated at its apex, which terminates in a pair of short incurving fingers. From its upper surface arises a pair of flattened titillators, curving upwards and basally, then downwards and diverging apically. These titillators are broad at their bases, apical two-thirds narrow and blade-like. Ventral lobe much narrower in ventral aspect, slightly constricted in its apical half. From the side, it is parallel-sided, apex truncate.

♀. Similar, except that abdominal segments one to seven are whitish. Eighth sternite slightly produced, centre of apical margin still further produced in a small, triangular lobe; this lobe is more pigmented than the remainder of the margin, and is connected to the main part of the segment by a narrow band of pigmentation. Ninth sternite strongly produced apically in an acute triangle, a narrow triangular membranous area at its centre from base to apex. In side view, this sternite resembles

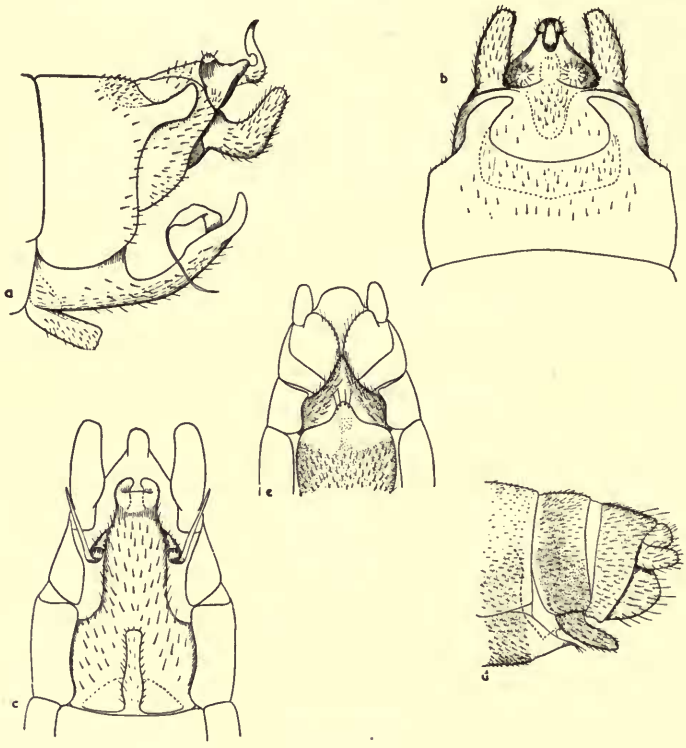

FIG. 37. *Spaniocerca tillyardi* sp.n. Genitalia ♂, *a*, lateral; *b*, dorsal; *c*, ventral; *d*, genitalia ♀, lateral; *e*, ventral.

the valves of a short ovipositor. Cerci short, sub-anal plates subtriangular, apices rounded.

Length of fore wing, ♂ 5·8–6·6 mm., ♀ 6·3–7 mm.

Length of hind wing, ♂ 4·9–5·8 mm., ♀ 5·2–6 mm.

AUSTRALIA: F.C.T., Lee's Springs, xi.1932 (R. J. Tillyard).

Type male, paratype female in form of microscope preparations, remainder in 2 per cent. formaldehyde solution.

### *Spaniocerca bullata* sp.n.

FIG. 38

♂ (in fluid). Head shining piceous, antennae piceous, finely annulated with yellowish at the sutures. Pronotum brown, quadrate, a little broader than long, angles

rounded, anterior transverse furrow deep, its ends curving backward. Meso- and metanota shining piceous. Legs dark brown, tibiae with a yellowish ring in basal half, below the knee. Wings pale smoky-brownish (anterior the darker), pterostigma darker, and a darker area over the transverse cord. Venation brown; no cross-vein in pterostigma; one to three medio-cubital cross-veins between M5 and transverse cord.

Abdomen pale brownish, segments nine and ten darker. Ninth tergite not produced. Ninth sternite produced in a large subgenital plate, broad from beneath, sides sinuous, apex rounded. From the side it is rather narrow, apex roundly truncate, and from the upper margins towards the apex arise a pair of slender arms,

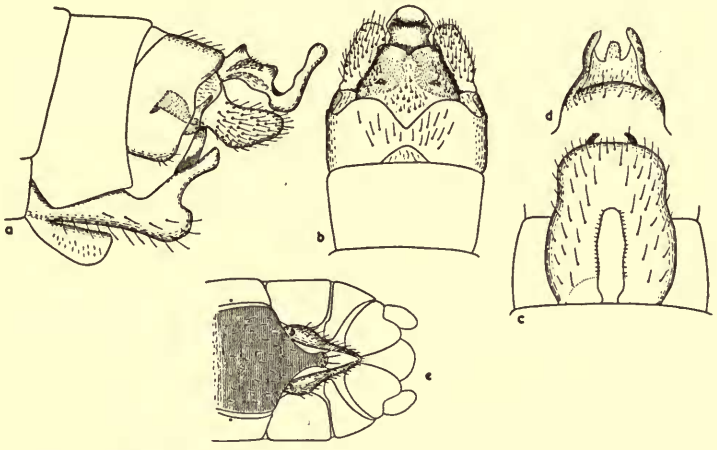


FIG. 38. *Spaniocerca bullata* sp.n. Genitalia ♂, *a*, lateral; *b*, dorsal; *c*, subgenital plate, ventral; *d*, apex of the same from behind; *e*, genitalia ♀, ventral.

curving tailward and inward. From behind, a membranous finger is seen between the incurving arms. Also towards the apex there arises from the upper surface a pair of flattened titillators, bent basally about midway, and in the type resting within the tenth tergite; in the paratypes these titillators are bent outwards at right angles to the line of the body. Ventral lobe short and deep from the side, rather narrow from beneath. Tenth tergite with a V-shaped excision at the centre of its apical margin. Supra-anal lobe trapezoidal at its base with four elevated knobs on its upper surface; the apex is produced upwards at right angles in a broad, rather thin lobe with a rounded apex. Cerci short, stout, slightly angled near the base in side view, tapering to a rounded apex. At the base is a small narrow sclerite.

♀. Similar to male, larger, wings with a faint indication of a cross-vein at base of pterostigma. Genitalia following the pattern of *S. tillyardi*. Eighth sternite more strongly produced at its centre in a slender, slightly clavate lobe. The whole sternite evenly pigmented. Ninth sternite triangularly produced, blade-like from the side, definitely narrower than the eighth sternite. Sub-anal plates broad, from beneath outer margin concave, apex rounded. Cerci short, somewhat ovate from beneath.

Length of fore wing, ♂ 8 mm., ♀ 9 mm.

TASMANIA: no other data (J. W. Evans), 3 ♂, 4 ♀.

The specific name *bullata* refers to the four knobs on the supra-anal lobe. Type male, paratype female in form of microscope preparations, remaining paratypes in 2 per cent. formaldehyde solution. The female is associated on general appearance and on similarity of genital structure with *S. tillyardi*, with which species the male shows more affinity than with *S. tasmanica*. The form of the supra-anal lobe and subgenital plate of the male distinguish it from *S. tillyardi*.

## *UDAMOCERCIA* Enderlein

*Udamocercia* Enderlein, 1909, *Zool. Anz.* **34**: 418.
Type species: *Leuctra antarctica* Enderlein, 1905 (Monotypic genus).

Wings similar to *Spaniocerca*, but without excision at apex of fourth anal vein in the hind wing. Anal fan narrower. Cu2 in fore wing relatively longer.

♂. Ninth tergite not produced; ninth sternite produced, long, slender ventral lobe at base. Titillators slender, upcurved, arising from membrane below tenth tergite, not from apex of the ninth sternite. Supra-anal lobe either in the form of an upwardly directed hook arising from a broad base, or downwardly directed and bifurcate. Cerci one-segmented, short, quadrate, or bent inward.

♀. In the South American species the eighth sternite is produced in a long sword-like ovipositor. I have seen but one Tasmanian example which I believe to belong to this genus. In it the eighth sternite is produced and elevated in a short triangular subgenital plate, notched at its apex. The ninth sternite is strongly chitinized and its apical margin triangularly produced. From general appearance of the wings, this female appears closer to *U. albomacula* than to *U. bifasciata*, but as it bears no other data than Tasmania, I am not assigning it to either of these species.

Enderlein originally asssociated the type species with *Leuctra*, but it is more Nemourid than Leuctrid. It has five anal veins in the hind wing, whereas the Leuctridae have only three, and M3+4 is not partially fused with Cu1, as is the case with *Leuctra*, which thus has an apparent fork to Cu1, and an apparently unforked medius in the hind wing.

### *Udamocercia albomacula* sp.n.

FIGS. 39, 40 *a–c*

♂ (dried). General colour piceous, shining. Head broader than pronotum; antennae slender, shorter than fore wing. Pronotum broader than long, broadest before the middle, side margins definitely angled at broadest part; a distinct, anterior transverse impressed line. Legs dull yellowish-brown, with darker markings at knees, base of femur, and apex of tibia. Wings light smoky-brown with paler areas at centre of pterostigma, distad of transverse cord, between branches of cubitus, and near base of fore wing. Venation brownish. Abdomen brownish. Ninth tergite not produced, sternite narrow, apical margin produced in a slender tongue, at least as long as sternite, curving upward from the side. Ventral process slender, pointed apically. Tenth tergite with an excision of its basal margin from above, apical margin produced,

rounded, its centre curling downward, and clothed in a dense mat of short black setae. From beneath it arises the supra-anal lobe, whose base is a broad rounded plate. Its apical margin is extended upwards as a slender hook, on each side of which is a small rounded lobe. Titillators two, slender, upcurved, membranous on upper surfaces, very flexibly attached to the membrane below the tenth tergite. Cerci short, stout, quadrate, with a chitinous plate at base.

♀ unknown.

Length of fore wing 5·8 mm., of hind wing 4·9 mm.

TASMANIA: Cradle Mountain, 16.i.1917, 1 ♂ (R. J. Tillyard).

Type pinned, with the abdomen mounted in balsam.

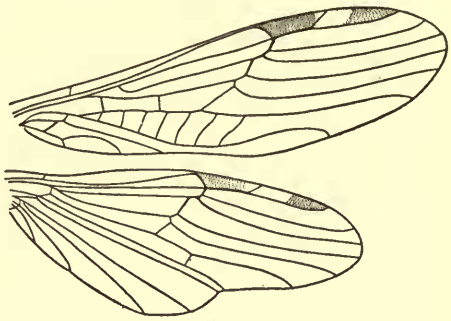

FIG. 39. *Udamocercia albomacula* sp.n. Wings.

### *Udamocercia bifasciata* sp.n.

FIG. 40 *d–f*

♂ (in fluid). Head shining piceous, palpi and basal segments of antennae fuscous (remaining segments lacking in type); pronotum fuscous, slightly broader than long, anterior transverse furrow distinct; angles rounded, lateral margins slightly convex. Meso- and metanota fuscous. (Legs lacking in type.) Wings light smoky-brown, anterior darker than posterior, and with two distinct white transverse fasciae, the

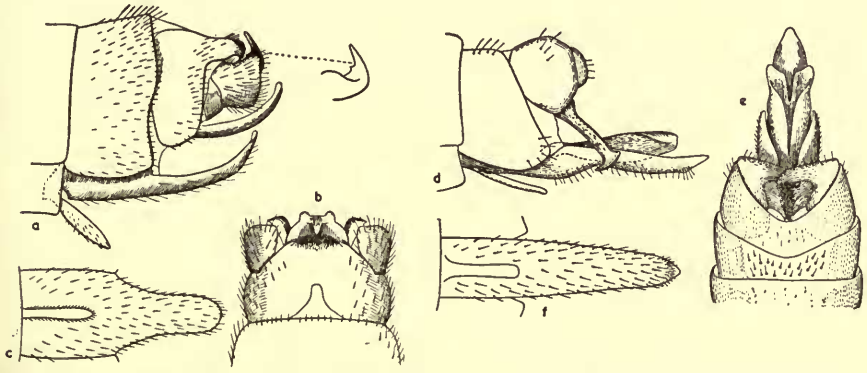


FIG. 40. *Udamocercia* spp.n. ♂ genitalia. *a–c, U. albomacula*; *d–f, U. bifasciata*. *a*, lateral; *b*, dorsal; *c*, subgenital plate, ventral; *d*, lateral; *e*, dorsal; *f*, subgenital plate, ventral.

outer straight, at the level of the base of the pterostigma, the inner curved, concave side towards the apex of the wing, running from apex of Sc basad of transverse cord nearly to apex of Cu2. Venation brownish, a faint cross-vein at base of pterostigma in both wings. In posterior wing R4+5 separates from R2+3 beyond the transverse cord. Abdomen lightly chitinized, segments eight to ten brownish, but membranous dorsally. Ninth tergite rather narrow above but longer at its lateral margins. Ninth

sternite produced in a long slender subgenital plate, acute at its apex, and at first glance resembling an ovipositor. Ventral lobe slender, about as long as lateral margins of ninth tergite. Attached to the membranous upper surface of the subgenital plate towards its base are a pair of elongate titillators, fused throughout most of their length, apex shallowly emarginate, with a deep narrow excision at its centre. Tenth tergite small, strongly chitinized at the sides, and bearing a pair of strong, inwardly hooked cerci whose bases only are visible from the side, appearing as small lobes. Supra-anal lobe directed obliquely downward, deeply forked in dorsal aspect, each branch from the side seen as a slender process with a dilated and hooked apex, placed on either side of the subgenital plate.

Length of fore wing, 5 mm.

TASMANIA: no other data, 1 ♂ (J. W. Evans).

Type in form of microscope preparation. At some future date it may be necessary to erect a new genus to contain this species, but for the present, in view of the scanty material available, it is proposed to place it in *Udamocercia*.

## APPENDIX

This paper, though virtually completed in 1941, could not be published under war conditions and was revised in 1948, following the receipt of more material. Further delays in publication ensued, and since it went to press I have received from Dr. W. E. Ricker (April 1951) a reprint of his paper 'Some Evolutionary Trends in Plecoptera' (1950, *Proc. Indiana Acad. Sci.* **59:** 197–209) in which he proposes a new subfamily name NOTONEMOURINAE (type genus *Notonemoura* Tillyard) and includes also the genera *Spaniocerca* Tillyard and *Spaniocercoides* Kimmins. My conception of this subfamily is wider, embracing the genera enumerated on pp. 84–85. Nevertheless I have adopted Dr. Ricker's subfamily name, but allowed my original definition to stand. D. E. K.

# INDEX

Synonyms printed in italics.